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Using the market for cost-effective environmental policy

Market-based instruments in Europe

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European Environment Agency

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Contents

Preface

This report is a condensed version of *Market-based instruments for environmental policy in Europe (2005)*, the fourth report by the European Environmental Agency on market-oriented instruments available to environmental policy-makers. The earlier EEA reports were: *Environmental taxes — implementation and environmental effectiveness (1996)* and *Environmental taxes — recent developments in tools for integration (2000),* and on environmental agreements: *Environmental agreements — environmental effectiveness (1997).*

This summary report and the larger report on which it is based considerably broaden the scope of the EEA's work in this area by covering a range of instruments. They include an overview of the use and experience of environmental taxes and charges, emissions trading schemes, subsidies, deposit-refund systems, and liability and compensation requirements, as tools for achieving environmental objectives in the whole European area.

The reports were written under the guidance of an expert group with members drawn from across Europe. The group met twice; in December 2003 to explore the issues to be covered and determine the appropriate analytical structure, and in December 2004 to discuss the final draft analyses. The members of the expert group commented on earlier drafts of the chapters during 2004.

The expert group included: Professor Frank Convery (University College of Dublin), Kai Schlegelmilch (German Ministry for Environment), Bob Davies (DEFRA-UK); Manfred Rosenstock and Madeleine Infeld (European Commission); Marina Markovic (consultant); Nils Axel-Braathen and Bertrand Le Gallic (OECD); Professor Mikael Skou Andersen (National Environmental Research Institute, Denmark); Petr Sauer (Prague University), Jan Pieters (Dutch Ministry for the Environment), Professor Thomas Sterner (University of Goteborg), Frans Oosterhuis (Institute for Environmental Studies, Free University of Amsterdam) and Eduard Interwies (Ecologic). Responsibility for the contents of the report remains with EEA.

The report was drafted for the EEA by a team comprising the Institute for European Environmental Policy (IEEP), University College Dublin (UCD), Eunomia, and Stefan Speck, under contract 3223/B2003.EEA.51620. The project and report was led by Patrick ten Brink of IEEP, and had major contributions by Professor Frank Convery (lead author of Chapter 2 on emissions trading), Stefan Speck (lead author for Chapter 3 and 4 on taxes and charges, and environmental tax reform respectively). Other key authors include: Dominic Hogg of Eunomia (waste expertise), Ian Skinner of IEEP (on transport issues and subsidies), and Karen Hoyer (IEEP, on liability). Other important contributing authors include Saskia Richartz (on subsidies for fish), Dirk Reyntjens (fisheries), Agata Zdanowicz and Martin Farmer (agriculture) and Jason Andersen (on climate change and energy) all of IEEP, and Louise Dunne and Luke Redmond of UCD (emissions trading).

The project manager at EEA was Hans Vos.

Executive summary

1 Why market-based instruments?

Much environmental pollution and natural resource depletion comes from incorrect pricing of the goods and services we produce and consume. 'Market-based instruments' (MBIs) — such as taxes, charges, subsidies and tradable permits help to realise simultaneously environmental, economic and social policy objectives by taking account of the *hidden costs* of production and consumption to people's health and the environment, in a cost-effective way. These hidden costs include damage from air and water pollution, waste disposal, soils and species losses, climate change and the floods, heat waves and storms that it brings, and health costs. These costs are often paid by people who are not even benefiting from the use of these products, such as the next generation of children, the Arctic peoples who are on the receiving end of Europe's pollution, the poor living next to roads and factories, or pensioners without cars in big cities.

Market-based instruments can be particularly effective tools for dealing with the four major areas of action of the EU 6th environmental action programme, namely: tackling climate change, preserving nature and biodiversity, protecting environment and human health, and through the sustainable use of resources and management of wastes. They do so by addressing the sources of environmental pollution most relevant to these areas such as:

- emissions from power stations, industry, cars and aircraft (tradable emission permits, fuel taxes);
- increasing waste generation by households and other actors (waste disposal taxes, taxes on packaging, incentives for recycling);
- emissions resulting from houses and offices (incentives for improved insulation and energy efficient heating systems);
- emissions resulting from agricultural activities (fertiliser and pesticide taxes).

MBIs provide a stimulus to consumers and producers to change their behaviour towards more eco-efficient use of natural resources by reducing consumption per se, by stimulating technological innovation and by encouraging greater transparency on how much we pay for what. MBIs can therefore also contribute to wider sustainable development objectives in the EU and the goals of the Lisbon agenda.

Last but not least, some MBIs raise revenue that can either be earmarked as environmental expenditures, or can be used to offset taxes on labour and capital.

2 Types of MBIs

For the purposes of this summary, MBIs have been classified into five main types:

1. *tradable permits* that have been designed to achieve reductions in pollution (such as emissions of CO_2) or use of resources (such as fish quotas) in the most effective way through the provision of market incentives to trade;
2. *environmental taxes* that have been designed to change prices and thus the behaviour of producers and consumers, as well as raise revenues;
3. *environmental charges* that have been designed to cover (in part or in full) the costs of environmental services and abatement measures such as waste water treatment and waste disposal;
4. *environmental subsidies and incentives* that have been designed to stimulate development of new technologies, to help create new markets for environmental goods and services including technologies, to encourage changes in consumer behaviour through green purchasing schemes, and to temporarily support achieving higher levels of environmental protection by companies;
5. *liability and compensation schemes* that aim at ensuring adequate compensation for damage resulting from activities dangerous to the environment and provide for means of prevention and reinstatement.

Experience in recent years shows that the question of 'which instrument is best' has changed to 'which

mix of instruments is best', both in terms of using MBIs alongside other environmental measures such as regulations and in terms of using MBIs to meet environmental objectives in combination with economic and social objectives e.g. environmental tax reform and subsidy reform.

3 Who is using MBIs?

The use of market based instruments in environmental policy has gained ground substantially in Europe since the mid-1990s, especially in the areas of taxes, charges and tradable permits. Most of the action is taking place within countries, including the new EU-10, accession and transition countries in central and eastern Europe (Bulgaria, Romania, Turkey, Balkan countries). Comprehensive systems of pollution charges for air and water are in place in many of these countries, though the rates tend to be low because of concerns about people's ability and willingness to pay. Several countries have also introduced resource use and waste taxes. One can see progress on the diffusion of taxes and charges on products notably for beverage cans and other packaging.

Within the EU-15, the Scandinavian countries and the Netherlands, who were early starters on environmental tax reform, remain at the forefront of developments. Germany and the United Kingdom have made much progress since the late 1990s. Within countries most applications happen at the national/federal level but increasingly we can see instruments being applied at regional and cities' levels, notable developments being resource taxes in regions like Flanders and Catalonia and congestion charging in some cities.

The use of environmental taxes and charges has widened since 1996, with more taxes on CO_2, on sulphur in fuels, on waste disposal and on raw materials, plus some new product taxes. Only a few tax rates have originally been set on the basis of an assessment of environmental costs: e.g. the landfill tax and the levy on quarrying of sand, gravel and hard rock, both in the United Kingdom.

At the EU level, emissions' trading has become the instrument highest on the political agenda with the adoption of the EU emission trading directive, for reducing CO_2 emissions, its transposition into national laws and the establishment of national emissions allocation plans. The trading system started operation in January 2005. There are a number of other trading schemes already in operation across EU-15 countries including national emissions trading schemes for CO_2 in Denmark and the United Kingdom, and for NO_X in the Netherlands, certificate trading for green electricity in Belgium, and transferable quotas for fisheries management across a range of countries such as Estonia, Iceland, Italy and Portugal.

A range of other instruments are either planned or under serious consideration notably pricing policies for water by 2010 under the EU water framework directive, road charging systems, and the increased use of trading certificates for green electricity. These and other initiatives suggest that the use of market-based instruments is likely to increase further in coming years, possibly as part of wider initiatives on environmental tax and subsidies reforms.

4 How well do MBIs work

Evidence suggests that instruments where they have been applied work better if:

- they are well-designed in themselves and as part of a wider package of instruments;
- the reasons for having them and how revenues will be used are clearly communicated;
- the levels at which 'prices' are set reflect both an incentive to producers and consumers to change behaviour and a realistic analysis of affordability.

Taking each instrument type in turn and looking at its effectiveness:

1. *Tradable permits*: it is too early to evaluate the success of the EU trading scheme for CO_2 emissions. Nevertheless, the positive reactions in financial markets, the lively trade at times, and the more than tripling of the carbon price (as of September 2005) since the start of the trading scheme, suggest that the scheme is making progress in the right direction. Also, the scheme provides a potential 'first-mover' advantage to European businesses, so possibly enhancing European competitiveness and innovation. Many companies are establishing carbon management systems for the first time. More importantly, now CO_2 has a price, companies under the scheme are looking for new technologies to reduce costs of such pollution. In addition, a whole range of new businesses are emerging — carbon traders, finance specialists and auditors to name a few. The scheme is estimated to allow the EU to achieve its Kyoto target at an annual cost around EUR 3–3 ½ billion compared with nearly EUR 7 billion without it. There are about three

decades of experience from trading schemes in the USA. Some European countries have trading schemes in place in the fishery sector since the 1980s and 1990s. US experience confirms that emissions' trading has a large potential for savings on the costs of complying with the objectives and targets set under environmental legislation. It is clear from this and other experiences that trading can be a powerful tool for delivering environmental objectives in a cost-effective way, but that instrument design and implementation protocols are crucial to success. Emissions trading works better if the number and diversity of sources under the 'cap' is larger, and if technological requirements for individual sources are less stringent. This offers the opportunity to broaden and deepen the EU scheme in the second phase 2008–2012 and also to reconsider the balance between trading and technological fixes at plant level.

2. *Environmental taxes:* evidence on the environmental effectiveness of taxes is broadly positive; in general they work when the tax is sufficiently high to stimulate measures to abate pollution levels. Austria, Denmark and the Netherlands are using different policy packages to reduce CO_2 emissions. The use of market incentives, i.e. both taxes and subsidies, in Denmark has been assessed to be a more effective form of policy intervention than other approaches, such as the Dutch mix of long-term voluntary agreements and subsidies, and the relative 'laissez faire' policy in Austria. Taxes on motor fuels, applied in all countries, together with taxes on the sales or registration of motor vehicles, account for over 90 % of the total environmental tax take in the EU. Taxes make up 40–60 % of the sales price of motor fuels in European countries, which is a considerably larger share than in the US. The European car fleet is consequently more energy efficient with up to 2–3 times lower unit emissions of CO_2 from transport than in the US. Tax differentiations for low sulphur and unleaded fuels have been particularly effective in changing producer and consumer behaviour towards innovation and purchasing decisions that reduce air pollution. Minimum tax rates have been laid down in the 2003 EU energy products taxation directive. Tax rates will rise in many of the new and some of the older EU Member States after transitional periods. Taxes in the areas of waste and resource use include products with notable success seen for the plastic bag tax in Ireland, the nutrient surplus charge in the Netherlands, the Danish waste disposal and batteries taxes, and the Norwegian pesticides tax. Several countries including Austria, Norway and Finland have abolished fertiliser taxes suggesting difficulties with implementation and perceived effectiveness. The Netherlands has also withdrawn its tax on land-filling of sewage sludge as it was deemed ineffective because support was minimal and enforcement difficult.

3. *Environmental charges*: progressively graduated water prices have been particularly effective in helping to reduce consumption over time in some countries (e.g. Denmark, Hungary). Charging for waste collection at the household level is sometimes based upon combinations of bin size, frequency and weight which helps to increase waste generation awareness and to reduce waste supply. Experience from the Netherlands shows that charges to reduce waste water emissions at source alongside investment in treatment facilities have provided a much more cost effective outcome in terms of meeting pollution reduction targets than in other countries where the primary focus has been on capital investments. Charging systems, such as road pricing, have more potential than the current fixed transport taxes and charges to directly and accurately charge transport users for hidden costs of using infrastructure, such as accidents, and environmental and health impacts, and economic inefficiencies such as congestion. The London congestion charge and other infrastructure charging schemes in Austria, Germany and Switzerland are examples of such charging systems.

4. *Environmental subsidies and incentives (including green purchasing)* these instruments are widely used and effective for supporting the development and more rapid diffusion of new cleaner technologies, such as catalytic converters and low CO_2 vehicles, and renewable energies especially wind and solar power. Experience suggests that application of subsidies at an early stage leads to further (non-subsidised) technological developments. EU level subsidies through the Cohesion funds, supported by legislation, have also helped build the infrastructures for environmental services such as water supply, waste water treatment plants and waste treatment services. Evidence suggests though that the environmental and economic effectiveness of these subsidies could be improved through the application of taxes and charges to minimise waste water pollution at source and so help reduce capital investments. Subsidies combined with targets offer another

effective instrument mix that is being used to encourage diffusion of renewable energies in many European countries.

5. *Liability and compensation schemes:* these are relatively new field of environmental policy strengthened by the adoption of the EU liability directive with which Member States will have to comply by 2007. Liability has started to gain a more systematic coverage, and important economic players — especially the insurance and reinsurance industries — are moving into the area where the economic threat of having to make pay out major compensation payments is becoming real. Oil spill funds will be enlarged and waste site after-care funds established. Liability obligations can inspire technical improvement (e.g. double-hull ships).

5 Political barriers to MBIs and how to overcome them

There are several important political barriers to the implementation of market based instruments. These are:

Perceived impacts on competitiveness

There is no evidence that existing economic instruments have a major adverse effect on competitiveness at the macro and sector level. This is partly due to the design of the instruments (use of low rates of taxes and charges), partly to exemption possibilities to avoid cost impacts and partly due to well designed measures that compensate those affected by recycling revenues (e.g such as the NO_X charge in Sweden). However, there can be impacts on individual companies as some companies will be more able or willing than others to respond to the signals from taxes, charges and subsidies, or the opportunities of an emissions trading scheme. Therefore, the issue is not about 'unfair loss of competitiveness', rather increasing willingness and ability to respond will keep companies competitive, whereas polluting companies that cannot adapt have usually had to close. Competitiveness issues have often been given greater weight than is justifiable when selecting or designing instruments or when granting or designing subsidies.

Equity concerns

Concerns about unfair burdens on householders have been a key influence when pricing schemes were introduced for the provision of energy supply, water supply, wastewater treatment and waste collection in many countries, notably in central and eastern Europe. This has led to different approaches to taxation on household energy and water consumption, for example, to better reflect people's ability to pay. Applying taxes in full, in combination with compensation for the poorer households, would maintain the tax incentive.

Perceptions, rules and legacies

In addition, there are a wide range of perceptions, rules, institutional structures, existing regulations and financial instruments that prevent wider uptake of market based instruments. Chief among these are:

- the perception that taxes have to be high if they are to work. This can undermine alternative approaches that take a long-term view over several decades whereby taxes are set at a low, affordable level to begin with and then gradually increased, taking into account inflation, and the target group's ability to adapt and change behaviour;
- the perceived conflict between maintaining revenues and changing behaviour. In this case tax authorities fear that with reform there will be a reduction in overall tax take at least in the short term; experience in Sweden shows that this can be overcome through well-designed measures and long-term, gradual, transparent and well-communicated approaches to reform;
- the perceived (and sometimes actual) conflicts between national, EU and world trade rules whereby countries' room for manoeuvre on either extending the instrument base or reforming taxes and subsidies is limited;
- the legacies of economically and socially desirable subsidies in the energy, transport, agriculture and other sectors that result in environmentally harmful effects.

Despite progress in some areas, there continues to be substantial economically motivated subsidies in the energy (e.g. on fossil fuels), agriculture (e.g. on production payments) and transport (e.g. tax allowances for commuters) sectors that result in environmentally damaging effects. There is also a continuing lack of sufficient horizontal coordination in many countries that prevents integrated approaches being taken to design and implement measures that combine economic, environmental and social considerations.

How to do better

Most barriers to implementation can be overcome by:

- the progressive removal of subsidies and regulations that contribute to environmental damage;
- the recycling of saved revenues to provide incentives for eco-efficiency and eco-innovation;
- the better design of instruments and mitigation measures to deal with inequities;
- progressive implementation supported by broad consultation and useful information so that people build up trust and confidence in the measures over time;
- the integration of market based instruments for environmental policy with those for economic and social policy so that revenues can be used to support broader tax reforms and in so doing contribute to win-win outcomes.

A closer look at the first and last of these measures is justified here:

Subsidy reform: results suggest that competitiveness concerns have often been taken too seriously when granting or designing subsidies. There are arguably too many subsidies that apply for too long. In some cases this reflects instrument design that was based on static responses rather than dynamic ones, thus overestimating the costs. Arguments of competitiveness need to be understood and defused and good research is needed early to avoid undue subsidies or inappropriate allocations. Positive financial incentives could play a stronger role in supporting environmentally beneficial technological innovation. This may be seen as a main driver for serving both environmental and economic objectives, and thus achieving the objectives of the Lisbon agenda. New technologies would be in a better competitive position and hence would require less financial support, if the negative environmental impacts of traditional technologies were better priced. Whereas financial support is usually destined to encourage development of environmental technologies (and to increase market penetration of marketed technologies) venture capital for the purpose of marketing is broadly lacking for such environmental technologies. Based on expected external benefits, governments could play a role here by absorbing part or whole of the financial risks involved in making new technology ripe for the market.

Environmental tax reform: market-based instruments that generate revenues can contribute to reforming taxes on labour and capital that have distorting effects on the market. This is even more useful because as Europe's population ages, and the available workforce dwindles, people will need increased incentives to stay in work longer.

At the same time reforming taxes and subsidies could release funds for promoting technological innovations in the face of global competition. In order to stop the *total* burden of taxes rising, the revenues from the green taxes on the things we don't like, (i.e. the creation of pollution and the inefficient use of resources) should be used to reduce taxes on the things we do like (i.e. on incomes, on profits and on investments). Pollution gradually gets reduced because the more realistic market price will be acting as an incentive on both producers and consumers to use the higher priced goods and services more efficiently.

6 A checklist for effective MBIs

There are many things we can learn from the latest analysis of environmental MBIs that together could provide a useful checklist of factors against which potential future successful MBIs could be assessed. These include:

1. Having an **instrument champion** who is willing to take the risk to make it work, for example, the London Mayor introducing the congestion charge.
2. **'Picking winners'.** Focus on the issues for which there is agreement and pressure to have them addressed, such as congestion problems or litter.
3. **Making optimal use of added value of MBIs in policy mixes.** Combinations of MBIs with e.g. information instruments increases environmental effectiveness. Mixes may also reduce monitoring and enforcement costs, as well as compliance cost uncertainty.
4. **Keeping it simple and understandable.** Make it easier to implement. Where possible, use IT to simplify schemes. Make charges easily understood and clearly communicated.
5. **Keeping it realistic.** Do not set charge rates higher than what is affordable.
6. **Giving advanced notice** of the introduction of a new instrument. Use phasing-in schemes to give people time to adapt and fine-tune the working of the system.
7. **Minimising changes.** Both regulators and industry benefit from stability in the regulatory environment. Allow time for lessons to be learnt from the first instrument (or mix of instruments) before making unavoidable changes.
8. **Understanding the potential of trade-offs** (e.g. across the three pillars of sustainable development and for different stakeholders), and work out which tradeoffs are unacceptable. This requires good impact assessments.

9. **Keeping stakeholders on board.** Early consultation and public participation as well as real understanding of their positions is critical. For example, the transparent use of revenues can defuse potential opposition to a tax charge.
10. **Maintaining equity** in implementation. Make sure the poor are not unduly affected or devise appropriate compensation schemes for them.
11. **Making sure that people can respond.** Substitutes should be available where possible. High taxes for private motorised transport, as e.g. targeted through fuel duty escalators in the United Kingdom and Germany, would be more successful if there had been appropriate substitutes, such as better public transport.
12. **Indexing** of tax/charge rates to inflation to avoid the erosion of value over time as has happened with some environmental taxes.
13. **Consistency.** Plan compatibility. Emissions trading works better the larger the market is. Schemes that emerge nationally should aim for international compatibility.

1 Introduction — why do we need market-based instruments for cost-effective environmental policy?

Over the decades, Europe has come a long way in improving environmental quality. Andreas Troge ([1]), commenting on the current lack of action to curb fine particle emissions from diesel vehicles, said ' …. if we had not installed catalytic converters back then (the 1980s), we would have to reduce our driving by 90 % today to get the same air quality'.

This is impressive, and points at effective environmental policy measures in the recent past, as well as at the great societal benefits of achieving environmental objectives. The introduction of catalytic converters in cars, necessary to achieve emission reductions prescribed by EU legislation, was made to happen through a variety of policy measures, including market-based instruments (MBIs). In many environmental areas, however, implementation of environmental regulation shows a deficit, and needs further reinforcing. Market-based instruments ([2]) will continue to play a role in reducing that deficit.

Environmental measures come with a cost. The older (EU-15) Member States spend 1.8 % of their GDP on environmental protection ([3]). These costs may rise further in the future, as environmental legislation tightens further. Although technological innovation, learning and economies of scale reduce unit abatement costs, many of the cheapest solutions have already been applied, and marginal abatement costs (additional costs per unit for further pollution abatement) are generally expected to rise in certain areas and sectors (e.g. CEC, 2004a ([4]); RIVM, 2005 ([5])). The ten new Member States spent about 1.6 % of GDP on environmental protection in 2000, four years before their accession to the EU, a higher percentage than in many of the older Member States; and this was expected to rise to 2–3 % in order to comply with the *acquis* requirements (Eurostat, 2002 ([6])).

The implementation deficit and the rising cost of environmental measures call for cost-effective solutions in the short term and further savings through technological innovation in the longer term. Market-based instruments help to reduce environmental costs, because they make optimal use of the diversity of economic activities. Some companies face high abatement costs, some lower costs. MBI can help to implement measures where they are the cheapest, which is favourable for society as a whole. MBI results in prices ([7]) to which individuals and firms react differently. For some it will be cheaper to reduce the use of the environment than to pay; it will be the opposite for others. Each will look for its own cheapest solution, either pollute and pay, or abate and save, thus securing an overall lowest-cost outcome.

Market-based instruments leave the choice of environmental technique to the firm. In the longer term they have the potential to boost technological innovation and the diffusion of existing techniques, because of the continuous pressure they exert on liable firms to look for cheap solutions. Technological innovation curbs rising abatement costs in the future. This dynamic efficiency potential is a demonstrated advantage over the most common forms of direct regulation that prescribe techniques or establish relative or absolute emission levels, and leave the regulated companies alone after compliance.

In presenting the case for market-based instruments in environmental policy, authors ([8]) commonly use one or more of the following arguments:

- they create incentives for behavioural change;
- they help to reduce the implementation deficit by providing flexibility;

([1]) Chief of German Environment Agency; according to Environment Daily 1699, 01/07/04.
([2]) Also called 'economic instruments'.
([3]) In 1999, source: Eurostat, 2001.
([4]) CEC, 2004; A comparison of EU air quality pollution policy and legislation with other countries, by AEA Technology and Metroeconomica.
([5]) RIVM, 2005, Nationale Milieuverkenning 5, 2000–2030.
([6]) Eurostat 2002, Environmental expenditure in accession countries — data 1996–2000.
([7]) Internalising external costs of use of environmental goods and services, or 'getting the prices right'.
([8]) Andersen *et al.* (2000), Kreiser (2002), Sterner (2003), among many others.

- they promote an optimal use of scarce resources;
- they induce technological innovation;
- they implement the polluter-pays and user-pays principles, helping to 'get the prices right';
- they help develop better, smarter regulation;
- they generate revenues that can be used for collective purposes, including reducing market-distorting taxes ([9]).

Are market-based instruments then the favourite tool in the total package of environmental policy measures? Do direct regulatory measures not internalise the price for use of the environment, and have the potential to achieve optimal results? In practice the differences are less sharp then they seem. Regulators have an eye for the characteristics of individual firms, and thus take into account differences in abatement costs to some extent ([10]). And direct regulatory measures also 'internalise' the use of the environment to some extent by making polluters pay for the measures they take. Taxes and other market-based instruments in practice are not what they are in textbooks, with exemptions for internationally competing industry, thresholds and limits, and rates that are usually lower than the costs of using the environment, if these can be calculated at all. There are also arguments from the theoretical side.

The theory of market-based policy instruments is firmly based in (neoclassical) economic theory, with its basic assumption of maximising the behaviour of producers (profits) and consumers (utility). Under this condition, producers will reduce their use of a non-priced environmental resource, under the influence of a tax that essentially creates an artificial price of that resource, to a level where it is just as expensive to pay the tax as to continue to reduce its use ([11]). This leads to an optimal use of resources ('allocative efficiency'). If this condition does not hold, for example because the firm's managers prefer to direct their attention to other activities over squeezing the last bits of utility from their resource or energy use, the firm may have stopped short of this optimal point. Also under the condition of this so-called 'X-inefficiency', the least-cost advantages of market-based instruments over direct forms of regulation may materialise ([12]).

Indeed, market-based instruments in environmental policy are commonly part of an instrument mix, and the policy choice question has evolved from 'which instrument is best?' to 'which mix of instruments is best?'

Market-based instruments used to be considered as useful 'add-ons' (e.g. OECD, 1989), which should successfully create additional incentives to existing regulatory measures for improving environmental effectiveness. There is a growing realisation that policy mixes need careful design, and that accumulating several instruments to address the same problem is not automatically the best solution. Johnstone (2003), for example, discusses four reasons for applying emissions trading systems (ETS) in combination with other instruments: (1) to reduce uncertainty in abatement cost, e.g. by setting penalty taxes for non-compliance, (2) to overcome technological market failures, e.g. by financial support for R&D, (3) to increase behavioural response, e.g. by providing information through eco-labelling, and (4) to address differences in local impacts, e.g. by imposing technological standards.

Administrative costs tend to rise when the number of instruments to address one problem increases, which negatively affects cost-effectiveness. Johnstone formulates several conditions for increased efficiency and effectiveness that should be satisfied when combining ETS with other instruments. The complementary instruments should be necessary, efficient and administratively feasible, and should preserve the benefits of the ETS to the greatest extent possible.

Alexander Pope (1688–1744) observed: *'Whoever hopes a faultless piece to see, hopes what ne'er was, is not, and ne'er shall be.'* That holds for market-based instruments. Nevertheless, these instruments, particularly when combined in clever mixes, have potential advantages over other approaches, including their significant and lasting influence on human behaviour . The challenge, which has been taken up, is to achieve these advantages in practice.

([9]) Environmental taxes and charges; auctioned emission allowances.
([10]) 'Enlightened' command-and-control policy, according to Burtraw and Palmer (2004).
([11]) Similar reasoning holds for consumers, with loss of utility instead of (monetary) costs.
([12]) 'X-inefficiency', caused by the factor X, unknown, or at least unfamiliar to economic analysis; see Van den Bergh *et al.* (1998) for a discussion of the impact of dropping traditional economic hypotheses for the theory of environmental economics and environmental policy.

2 Market-based instruments: what are they, what drives them, what inhibits their use?

2.1 Definitions

Many have tried to come up with definitions of economic instruments (e.g. OECD, 1994, Hahn, 1999). The OECD labels instruments economic 'when they affect estimates of the costs and benefits of alternative actions open to economic agents.' This definition focuses on the mechanics of the measure and points to the existence of financial incentives and freedom of response, thus creating a distinction with direct regulatory or administrative measures. Hahn points to the outcome and calls an instrument economic when it improves efficiency compared with a situation where another instrument would have been in use, or none at all. A carefully-designed administrative measure can be an economic instrument in his view. James (1997) observes: 'In reality, the distinction between direct regulations and economic instruments is often blurred as any system of economic instruments usually requires appropriate legislative or regulatory backing. Wherever economic instruments have been used, … supporting regulations have been applied.' His opinion represents a practical view, and points to the importance of policy mixes.

Rather than defining market-based instruments, this report lists the following environmental instruments as 'economic': emissions trading, environmental taxes and charges, deposit-refund systems, subsidies (including the removal of environmentally-harmful subsidies), green purchasing, and liability and compensation. In dealing with these instruments, policy mixes will not be lost from view. An important policy mix that has emerged recently is environmental tax or fiscal reform, which combines market-based environmental measures with measures in the fiscal and economic sphere.

2.2 What drives market-based instruments?

2.2.1 Guiding principles

The potential qualities of market-based instruments were recognised early in the evolution of environmental policy. Following academic debate and incidental application (see e.g. OECD, 1989, which lists the Scandinavian countries and the Netherlands as early users in Europe), market-based instruments were widely recommended at the European and global level in the last two decades of the 20th century. The 5th environmental action programme (CEC, 1993) mentions market-based instruments as important tools 'towards sustainability' as they '... encourage the production and use of environmentally-friendly products and processes.' Agenda 21 (UNCED, 1993) states 'Environmental law and regulation are important but cannot alone be expected to deal with the problems of environment and development. Prices, markets and governmental fiscal and economic policies also play a complementary role in shaping attitudes and behaviour towards the environment.'

The polluter-pays principle is a main guiding principle in environmental policy and is frequently invoked as the legislative justification for the broader use of market-based instruments. However, as originally formulated by OECD and adopted by the member countries, this principle only requests that '..the polluter should bear the expenses of carrying out the measures … to ensure that the environment is in an acceptable state.' This is a narrow definition as it leaves out any damage that may remain after the necessary measures have been taken. Many use a wider interpretation, wherein the polluter should bear 'the cost of pollution abatement, the costs of environment recovery and the compensation costs for victims of damages if any, due to pollution' (cf. Mountondo, 1999). The EU has followed this interpretation with the recent adoption of the environmental liability directive, which has been based explicitly on the polluter-pays principle (see Chapter 6).

Also in its wider interpretation, the polluter-pays principle does not request the polluter to pay for the use of the environment per se (see also Sterner, 2003, p. 111). The main guiding principle for the application of market-based instruments is the *economic principle of efficiency*. The costless use of objects that have a value for society is a

market imperfection that reduces efficiency and can be corrected by 'getting the prices right.' This is captured by the user-pays principle that complements the polluter-pays principle.

2.2.2 Drivers at the EU level

Apart from the environmental liability directive, other recent pieces of EU legislation include or even regulate market-based instruments. The water framework directive (EC, 2000) calls for the use of economic instruments (e.g. water pricing) for achieving good water status for all waters, in the most effective manner. The directive on energy products taxation (EC, 2003a) expands taxation to other energy products (coals, lignite, natural gas, electricity) and raises obligatory minimum tax rates. It introduces the possibility for Member States to tax aviation fuel used in inland flights. The packaging waste directive (EC, 1994) provides the possibility of adopting market-based instruments in the future to achieve the objectives of the directive, and leaves room for Member States to act earlier in this way. The emissions trading directive (EC, 2003b) is the first economic instrument introduced at the EU level, and is a major instrument for reaching the objectives of the climate change policy as adopted by the EU and the Member States. Finally, the European Commission is preparing a communication that will further clarify the role that market-based instruments can play in the EU's environmental policy, given the rules that govern the internal market.

Research and development is an important element of the Lisbon Strategy, which aims '*to make Europe the most competitive and dynamic knowledge-based economy in the world ...'*. When the sustainable development strategy was recognised as a complement to the Lisbon strategy, an environmental technology action plan (ETAP; CEC, 2003a) was launched. Market-based instruments are mentioned as facilitating tools for promoting the development and implementation of environmental technologies. ETAP calls for the correction of price distortions, such as insufficient pricing of the externalities of energy use, and the removal of harmful subsidies. It also provides funds for sharing the risk of investing in environmental technologies. It may be necessary to revise the EU's guidelines for State Aid for that purpose.

2.2.3 International agreements

International conventions act as further stimuli for the consideration of market-based instruments. The UNECE Convention on Long-range Transboundary Air Pollution (UNECE, 1999) contains quantitative ceilings for major air-polluting substances. The eighth protocol calls on the signatories to encourage the use of market-based instruments, among other measures, for reducing relevant emissions.

The Kyoto Protocol to the UN framework convention on climate change has set quantitative targets for the signatories for the period 2008–2012. The Convention called on the parties to 'coordinate as appropriate with other such Parties, relevant economic and administrative instruments developed to achieve the objective of the Convention.' The EU and the Member States as signatories developed the emissions trading directive as a cap-and–trade system for CO_2 that will enter its 'warming up' stage by 2005.

2.2.4 Revenues and the 'double dividend'

Some market-based instruments raise revenues. The revenues from *environmental taxes* commonly go into the public coffers and can be used to offset other taxes, or to help finance government programmes and other actions that are beneficial to the environment. The revenues from *environmental charges* are usually meant to finance collective services from which the charge payer benefits. Emissions trading systems raise revenue, if the credits are auctioned, although giving them away for free ('grandfathering') is the favoured option. The EU emissions trading system for CO_2 provides the auction option to a limited extent, but very little use is made of it. Finally, the reform of harmful subsidies may yield savings in the government budget, if it results in abolishing or reducing financial aid.

The potential employment effects of offsetting other taxes has often been mentioned as a major driver for the expansion of environmental taxation. Reducing taxes on labour and social security contributions will reduce the 'wedge' between gross and net wages and make labour cheaper for employers. Increased environmental taxes will make products more expensive, leading to higher wage demands, and it is far from certain that the 'double dividend' will actually materialise. An OECD overview of studies (OECD, 2001) found that employment may increase if the available extra revenues are used for reducing labour taxes and social security contributions, in particular when aimed at unskilled labour. If used for lump-sum payments to households or for reducing VAT, employment effects may be smaller or even negative. The general expectation that a 'double dividend' will occur indeed runs counter to the 'Tinbergen rule' that a state should have as many instruments as declared objectives (Tinbergen, 1952),

and hence environmental and labour policy-makers should design their own instruments. Any co-benefit is a happy side-effect.

Whether or not shifting the tax burden through market-based instruments creates additional employment, the impact on welfare is surely positive when such instruments are carefully designed. Fairer prices for the use of the environment improves the efficient use of scarce resources, and any possible reduction of taxes on labour, capital and consumption reduces market distortion, and thus also leads to a better use of resources.

2.3 What inhibits the use of market-based instruments?

The advantages of market-based instruments are judged differently in practice. Why are they not the dominant tool in the environmental policy package? The main reason probably lies in the difference between economic theory and political reality. Proposals for new instruments may go into the policy pipeline in a pure form, but will commonly be twisted by the demands of interest groups in order to secure progress to the final stage of adoption. This leads to adaptations that move the new instrument away from its desired design. Andersen (2000) mentions five 'design syndromes' particularly relevant for environmental taxes and charges. They relate to the tax base (design to respect big, influential polluters, putting the burden on the smaller ones, and to accommodate administrative feasibility), the tax rate (design to pursue fiscal rather than environmental purposes), the revenue destination (hypothecation such as keeping the revenues under control of those liable to the tax), the tax agent (unfamiliarity with or marginality of green taxes), and the link with other policy instruments (lack of interplay with or entangling with other policy instruments). Arguments frequently used by policy-makers to justify such adaptations include fear of loss of competitiveness and adverse effects on those with lower incomes.

2.3.1 Competitiveness

'Never let the tax tail wag the economic dog'
(L. Peebles) ([13]).

Roy *et al.* (2003) classify various taxes according to their impact on welfare. Taxes on labour, capital and consumption have a negative impact, taxes on economic rent have a neutral impact, and taxes on externalities have a positive impact. Calls on tax authorities to leave the 'economic dog' alone usually refer to the first category. But although market-based instruments for environmental policy belong to the third category and have the potential to increase welfare through improving the market, various actors in the market are generally less enthusiastic. They use the same 'wagging the dog' argument to underpin their objections and point to loss of market power vis-à-vis foreign competitors or domestic parties in the same market with a different industrial profile.

OECD (2001) points at the different meanings of 'competitiveness' at the national level, at the sectoral level, and for individual firms. Correcting market failures with correctly-designed environmental taxes improves the efficient use of resources and will give economies as a whole a better economic outcome. Increased costs for one sector due to energy taxation may be more than offset by reduced costs for another, e.g. through reduced labour taxes. Whether or not the whole economy will lose some of its competitive position on international markets will depend on the intensity of the taxed resources and the environmental policy of its main competitors. OECD (2001) refers to research that found an overall negative outcome of higher energy taxes for the Netherlands with its high energy-intensity export sector, but a positive result for the United Kingdom with its relatively small export of energy-intensive products.

Sectors within the national economy may win or lose from an increased use of market-based instruments, depending on the intensity of the taxed resources or the dominance of taxed, polluting processes. The Carbon Trust (2004) found no negative impact on competitiveness from the EU emissions trading scheme for CO_2 for the sectors under the cap, but concluded that the aluminium industry — not under the cap — would suffer as a result of higher electricity prices.

At the level of individual firms, more efficient or cleaner companies will suffer less or even gain from an increased use of market-based instruments, compared with less advanced colleagues. The Swedish charge on NO_X emissions from large emitters has been designed as a charge and refund system that is profitable on balance for companies that manage to reduce their emissions per unit of

([13]) It is the modern interpretation of the famous statement by Colbert (Louis XIV's Minister of Finance): 'The art of taxation consists in so plucking the goose as to get the most feathers with the least hissing.'

energy output below the average level for the liable group of industries as a whole.

Where sectors of groups of companies suffer loss of competitiveness in international markets, (supra-)national authorities can offer protection. One approach is through the use of border tax adjustments: taxing imported products or providing rebates for exported products, levelling taxes in domestic and foreign markets. The World Trade Organization has set rules for border tax adjustment. Another way of protecting industry is to offer tax reductions or exemptions, e.g. in exchange for increased efficiency or pollution abatement efforts. Denmark and the United Kingdom have included such provisions in their national climate-change tax systems. However, such provisions are regarded as indirect state aid by the European Commission, and have only been approved for a temporary period. The Swedish NO_X charge for large energy producers has a high charge rate (SEK 40 per kg), but is successful and acceptable because the revenues of the charge are refunded to the payers. The refund system, which is based on the energy output of the sources, provides a strong incentive to reduce the amount of NO_X per unit of energy produced.

Negative implications cannot always be avoided. 'Environment' as a production factor is no different from other factors such as labour: if correcting a market failure leads to higher prices, some competitive advantage may be lost. Wolff (2000) concludes that companies in general seem to favour emissions trading systems over taxation when some measure is bound to be taken, or when the system provides rebate elements. 'Grandfathered' emissions trading may provide windfall profits for some or all participants.

It may be seen as illustrative of the policy dilemmas that the economic instruments at the EU level combine an emissions trading system with an energy taxation directive. The tax rates are fairly modest, whereas quota prices are volatile but on the increase.

2.3.2 Income distribution

Since low-income groups in society pay the same environmental tax tariffs, and thus usually a higher proportion of their income than higher-income groups, such taxes are usually considered to be regressive. The overall impact on income distribution depends on several factors (cf. OECD, 2001). Some tax schemes have provisions to reduce the tax burden for lower-income groups, such as exemptions or tax-free thresholds (mitigation). Part of the tax revenues are sometimes recycled back to lower-income groups (compensation). Whether the use of tax revenues to reduce the tax burden on labour has a progressive impact depends entirely on the design. A general reduction of income tax may benefit higher-income groups more than those with lower incomes. Reduced labour taxes may, however, lead to increased employment, giving the jobless a chance to (re)enter the labour market, which will improve their income.

Evidence on the distributional effects of green taxes has been researched in an *ex post* analysis in Denmark ([14]). The country has the largest spectrum of environmental taxes in Europe, and many of the taxes have substantial financial significance, giving Denmark the highest share of the total tax and social contributions take from environmental taxes, at almost 10 %. The distributional impact of environmental taxes in Denmark may be significant. The analysis shows that while energy taxes have a regressive impact, meaning that the lower-income classes pay relatively more than the higher-income classes, transport taxes are progressive and pollution taxes about neutral. The regressivity holds especially for the electricity tax, which is levied pro rata on electricity consumption, and also for the taxes on retailer packaging and water. The taxes on petrol and vehicles work out progressively, burdening the lower-income classes less than the higher-income classes, although there are differences between the populations in urban and in rural areas, the latter having a higher transport need. The researchers conclude that shifting some of the burden of the CO_2 tax from electricity to petrol may reduce the regressive effects of that tax. The pesticides tax is progressive, but its financial significance is small. The regressive character of energy taxes is moderate and comparable to that of VAT, while it is less than in the case of conventional liquor and tobacco taxes. In Denmark the regressive effect has been mitigated through special compensation to single-parent households and retired people without retirement schemes/pensions.

Mitigation and compensation will reduce environmental effectiveness, but is frequently deemed necessary for socio-political reasons. In order to maximise the effectiveness of market-based instruments, social measures should be 'tailor-made' and directed solely at the groups that need it most.

([14]) Wier *et al.*, 2005 based on Klinge Jacobsen, 2005.

Like all environmental policy instruments, market-based instruments, when they are effective, may have a progressive impact on *welfare* distribution. More often than not, low-income groups live in polluted areas, such as congested inner cities or areas downwind of industrial sites. These groups may benefit most when measures lead to improved environmental conditions.

2.3.3 Other barriers

Other barriers frequently mentioned include lack of awareness, or misperceptions, partly through lack of economic capacity of policy-making institutions, of the potential of market-based instruments, prejudices, and possible high costs of implementation, monitoring and enforcement.

3 Emissions trading: break-through of a market-based instrument

3.1 The EU trading system for greenhouse gas emissions (EUETS)

3.1.1 The new system is 'cap-and-trade'

January 2005 was a landmark. It marked the start of the first EU-wide economic instrument, and the first supra-national emissions trading system in the world. It has been designed as a flexible instrument to help the EU and the Member States to achieve the targets of the Kyoto Protocol to the UNFCCC. The scheme runs a first 'pilot' phase until 2007 and continues in the second phase through the first commitment period for the Kyoto targets, 2008–2012. The EUETS currently covers CO_2 emissions from all of the larger sources in the power and heat sector, oil refineries and cokes ovens, and the production of ferrous metals, cement clinker, glass, tiles, bricks and porcelain, and pulp, paper and board, about 11 000 installations in all.

The EU scheme is a *cap-and-trade system (see Box 1) Absolute quotas are issued, allowances can be bought and sold, and the emitter must surrender sufficient allowances each year to cover emissions in the previous calendar year. The scheme allows linking to the clean development mechanism (CDM) and joint implementation (JI) schemes under the Kyoto Protocol, and liable actors under the EUETS may convert CDM and JI credits from 2005 and 2008 respectively to cover their emissions.*

3.1.2 Allowances are 'grandfathered'

The EUETS requires that at least 95 % of the initial allowances are 'grandfathered', although there are good arguments for auctioning. Bohm (1999) points out that the revenues from auctioning allow for a reduction of other market-distorting taxes (the 'double dividend' argument). The auction price reflects the value of environmental use and corrects a market imperfection. Grandfathering also allows firms who would not have been able to acquire credits in the auction to remain in business. This is less acceptable from the point of view of economic efficiency, but may be preferable for social reasons. Moreover, firms that would have been able to pay for their allowance, or would have reduced emissions anyway as a consequence of commercial decisions, get them for free under grandfathering. This creates an extra benefit

Box 1 Cap-and-trade or baseline-and-credit?

Emissions trading systems can either be *cap-and-trade* or *baseline-and-credit*. In the cap-and-trade form each installation receives emission allowances at the start of the system and must prove each year that actual emissions have not exceeded allowances, or that additional allowances have been bought. Any surplus allowances can be sold. Hence there is an absolute quantity of allowable emissions (cap).

In the baseline-and-credit (also called rate-based) form, emission allowances are defined relative to some business parameter, such as energy generation or consumption. The series of allowable emissions for relevant years form the baseline that is dependent on the performance of the economic subject. Emitting less than the baseline for a certain year delivers credits that can be sold to those who do not manage to keep to the baseline level. There is no absolute cap in a baseline-and-credit system, but allowable emissions expand and shrink with economic activity.

Once the baseline allocations have been established, the cap-and-trade system is administratively easier than the baseline-and-credit system, for which allowances must be calculated each year. Moreover, the baseline-and-credit system can be environmentally ineffective if economic expansion is greater than expected.

When policy targets have been formulated in a quantitative form, clearly the cap and trade system is the preferable option. This is the case with the EU emissions trading system for greenhouse gases.

('windfall' profit) that results in a sub-optimal allocation of resources.

On the other hand, there are arguments for giving allowances away for free. Tietenberg (2001) argues that allowances will end up where they are most cost-effective, irrespective of the allocation mechanism, because of their transferability. Hence their initial distribution is irrelevant. Allowances can be seen as an economic rent, the taxing of which is welfare-neutral (cf. Roy, 2003). A pragmatic and most relevant argument of course is that free allowances are more likely to result in the necessary political support by the relevant sectors.

As appears from the finalised national allocation plans ([15]), only Denmark has made full use of the option of 5 % auctioning. Most countries have not provided for auctioning.

3.1.3 Banking and borrowing?

Those who have surplus allowances can also store them for later use (banking). This is allowed in the first phase of the EUETS. None of the Member States have allowed banking into the first commitment period, beginning 2008.

Those who have a shortage of allowances can, if permitted, 'borrow' some from a future year within the same period to fulfil the requirements of the current year. The EUETS provides a limited borrowing option: allowances for the current year are provided by the end of February, whereas commitment for the previous year must be demonstrated by the end of April.

Banking and borrowing may add flexibility to the system, for example to dampen price effects as the result of sudden peaks in the demand or supply of allowances.

3.1.4 Monitoring and enforcement

Monitoring is done by the national 'competent authority' which issues allowances and checks the sufficiency of allowances surrendered by liable installation managers. The basis for monitoring and enforcement is a national registry as an electronic bookkeeping system for issuing, holding, transferring and cancelling allowances. All transfers of information between national registries are supervised and checked by a transaction log run by a central administrator.

Penalties for non-compliance amount to EUR 40 per tonne of CO_2 in the first phase, and EUR 100 per tonne of CO_2 in the second phase. These are rather severe given the allowance prices that have emerged during initial trading, which run from EUR 7 to EUR 20 ([16]) per tonne of CO_2.

3.1.5 Evaluation

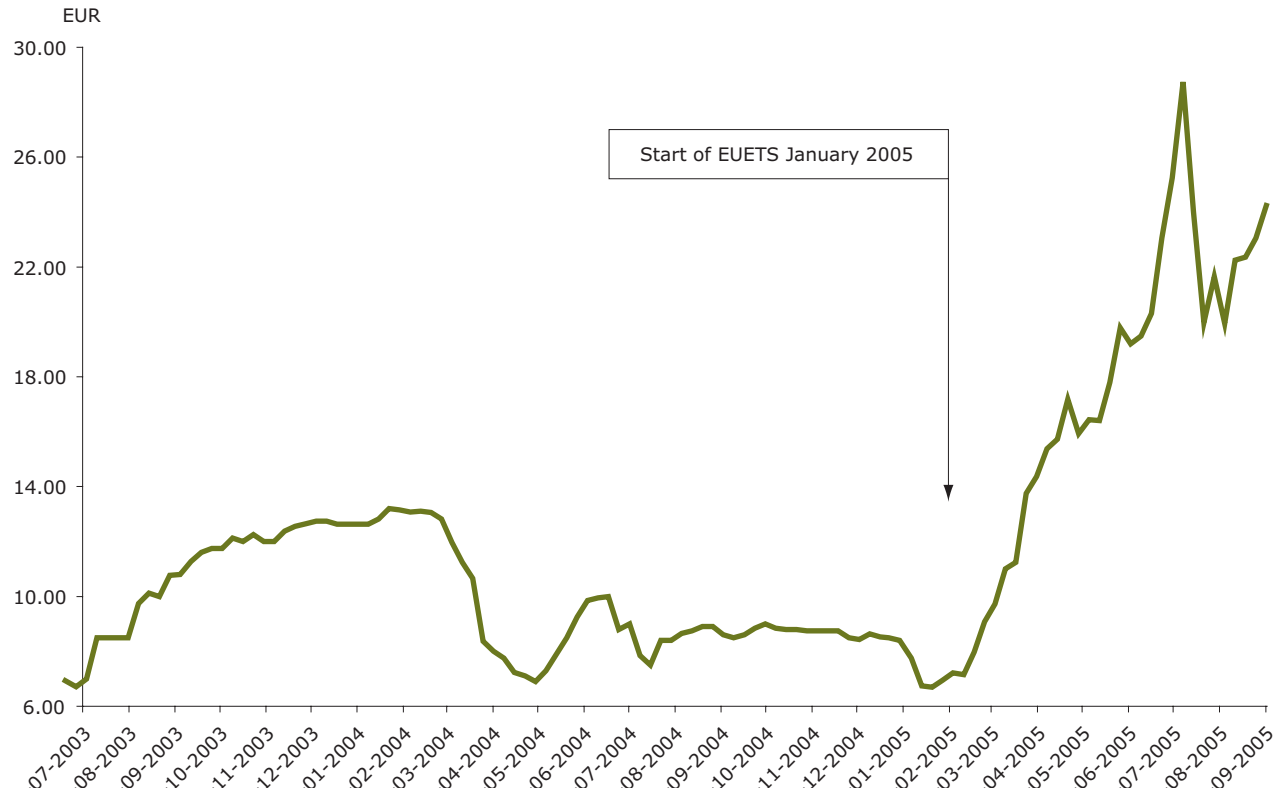
Does the EUETS meet the theoretical requirement of optimal efficiency? The value of emissions trading lies in benefiting from differences in marginal abatement costs, allowing participants flexibility to choose their own optimal solution. The larger the variation in economic activity and geographical location under the cap, the larger the differences in abatement costs are likely to be. The market for the EUETS is indeed deep (a range of different activities) and wide (a large part of Europe). The market has been expanded further through the so-called 'linking directive' ([17]) which allows parties under the EUETS to make use of emission reduction credits, earned in Joint Implementation projects in countries with quantitative emission reduction targets, or of certified emissions reductions, earned in clean development mechanism projects in countries without such targets.

The price of CO_2 allowances has fluctuated in the pre-EUETS period, stabilising at the EUR 7–9/t level in 2004 (see Figure 1). The price started to climb immediately after the introduction of the EUETS in January 2005, to a level of almost EUR 29 per tonne in July 2005, then decreasing to about EUR 20. A price of EUR 20/t CO_2 is equivalent to EUR 73/t C. In an overview of assessments of the marginal damage costs of CO_2 emissions, Tol (2003) found an expected value of EUR 57/t C ([18]).

The system does not cover all activities and gases relevant to climate change. About 2.15 billion allowances (of one tonne of CO_2 each) have been allocated ([19]), covering roughly half of all CO_2 emissions. The other five gases in the Kyoto basket, which account for 20 % of European greenhouse gas emissions, are not yet part of the system. In particular, transport is a large and increasing source

([15]) As of June 2005.
([16]) EUR 19.40 on 8 June 2005.
([17]) COM (2003) 403 final.
([18]) Taking the values of the peer-reviewed assessments only.
([19]) As of 13 June 2005, 11 105 installations have received 2 158 million allowances; 15 national allocation plans were approved, 9 were pending.

Figure 1 Prices of CO_2 allowances from June 2003 until September 2005



Source: Point Carbon (Carbon Market Europe), www.pointcarbon.com.

of greenhouse gas emissions, not covered by the system. Aviation is likely to have a much larger impact on climate change than that associated with its CO_2 emissions only, due to the emission of water vapour, sulphate aerosols, soot, and the creation of cirrus clouds through con-trails.

Another requirement is simplicity and transparency. The barriers to trade and the associated transaction costs should be as low as possible. The EUETS has achieved simplicity to a considerable extent. Price information is readily available, because brokers are accommodating transactions.

Auctioning in the allocation phase has several advantages that remain largely unexploited in the pilot phase, e.g. regarding equity. The burden of higher prices for some products, such as electricity, may fall heavily on subjects outside the system (households, SMEs), whereas companies inside the system may benefit from receiving free allowances.

Moreover, with a fixed national target for emission reductions (under the burden-sharing agreement), generous allocation of quotas to the cap-and-trade sectors would directly impose stricter emission reductions for sectors not in the EUETS, and for the national governments (tax payers) if the flexible mechanisms under the Kyoto Protocol have to be used to a larger extent. The distribution of the burden could be negatively affected.

Dales (1968) observed: *'If it is feasible to establish a market to implement a policy, no policy maker can afford to do without one.'* The view of economists is that the key merit of emissions trading is that it facilitates and encourages abatement to take place wherever it is cheapest to do so, and hence contributes to savings. The EUETS, to a reasonable extent, takes political feasibility into account, complying with that view.

3.2 National trading systems

3.2.1 CO_2 trading

Denmark and the United Kingdom have introduced trading systems for CO_2 emissions in anticipation of the EUETS. The Danish system is of the cap-and-trade type, but the rather low non-compliance fee of DKK 40 (EUR 5.40) per tonne makes the cap rather

soft. Actual trading involved about 1 % of the cap (nine transactions) which includes 90 % of the CO_2 emissions from the electricity sector (eight sources), and about 30 % of the GHG emissions in Denmark.

The United Kingdom's CO_2 emissions trading scheme, introduced in 2002 and running until 2006, has two types of participant — those who have accepted an absolute cap, and those who have agreed to a relative target.

As the UK ETS is a voluntary scheme and its participants would also have to pay a climate change levy (CCL) on their energy consumption, the government provided a financial incentive for sources that have taken on annual voluntary targets for the five-year period 2002–2006. The targets and level of incentive payment were set through a competitive auction, whereby sources sold their reductions against their baselines to the government for the entire period 2002–2006, divided into five equal annual targets. The auction resulted in a price of GBP 53.37 (approximately EUR 80), paid by the UK government per tonne of emission reduction by the 34 direct participants in the scheme. Emission reductions amounted to approximately 4.6 million tonnes of CO_2, or 11 % from the participants' baselines in 2002, increasing to 5.2 million tonnes in 2003, and 5.9 million tonnes in 2004, or about 8 % of the planned reductions in the United Kingdom's annual emissions by 2010.

31 out of 32 direct participants are in compliance and meet their emission reduction target (DEFRA, 2003).

The companies that have concluded climate change agreements (CCAs) that entitle them to an 80 % reduction of the climate change levy as long as they meet certain emissions reduction targets, can use trading either to help meet their target or to sell any over-achievement. CCAs are voluntary agreements for industrial sectors for committing to certain challenging energy-efficiency targets.

The link between the emissions trading scheme and CCAs is known as a gateway. The gateway puts no limit on the sale of absolute sector permits into the 'relative' sector, as these permits are based on absolute emission reductions. However, the sale of compliance credits under CCA (relative sector) into the ETS (absolute sector) is restricted, and allowed only as long as the total historic sale in this direction does not exceed the quantity of absolute sector permits previously sold into the relative sector. This is aimed at ensuring that there will be no net transfer of allowances from the relative to the absolute sector, as otherwise this could undermine the total emission reduction achieved in absolute terms.

Both direct participants and CCA participants were allowed to 'opt-out' of the EUETS in the first period 2005–2008. Credits acquired under the UK ETS however cannot be banked for use under the EUETS, hence markets for allowances are not connected, and allowance prices will differ.

In summer 2004, allowances were traded at GBP 3.12 to GBP 3.50/tonne CO_2.

3.2.2 Tradable fish quota

The first national tradable quotas system in Europe was the Individual Transferable Quotas system (ITQ) in the fisheries sector in Iceland (1984). The capacity of the sector had outgrown sustainable levels of landings. Financial returns on investment were insufficient to keep the sector healthy. The ITQ system reduced the number of fishing boats, increased the efficiency of the sector and brought the landings better in line with fish stocks. Denmark, Italy, the Netherlands and Portugal also operate ITQ systems in their fisheries sectors.

3.2.3 NO_X trading

On the basis of the national NO_X reduction target established in Directive 2001/81/EC (NEC directive), the Dutch government has set a target of 55 ktonnes of NO_X emissions by 2010 for its large industry sectors.

The Dutch government implemented NO_X emissions trading for large stationary installations in 2005. The NO_X trading scheme will apply to all industrial facilities with installed total thermal capacity above 20MWh. This involves approximately 250 facilities whose NO_X emissions in 2000 were about 90 ktonnes. The aim is to reach the 55 ktonnes target by flexible means, as command-and-control was predicted to be too costly for certain sectors.

The scheme is of the baseline-and-credit type. Baseline emissions are calculated by multiplying the standard NO_x emissions per GJ energy input by actual energy input over the year (Nentjes, 2003). The scheme uses a decreasing standard up to 2010, of 65 g per GJ in 2004 to 50 g per GJ in 2010, with scope for further tightening in later years. Non-compliance will be dealt with by moving the deficit to the next year's budget with a 30–40 % (physical) penalty addition. Limited borrowing and banking is allowed, up to 10 % of each source's 2004 NO_X allocation, 7 % of 2005 allocations and 5 % of allocations in the years thereafter.

The compromise of relative targets made the scheme more acceptable to industry. The environmental management law, based on the ALARA (emissions should be as low as reasonably achievable) principle needed to be amended, in order to make the system legally possible. The amendment introduced a two-tier system of regulation. Firms can only participate in trading if they have a licence to do so. Even if a firm wants to buy credits to increase its emissions, it cannot do so beyond the standards set by the EU IPPC directive and ALARA. With the system, the Netherlands aims to 'experiment' and anticipate a possible future amendment of the IPPC directive, which will facilitate freer trading.

The system is expected to yield cost savings (44 % savings over standards alone, according to Nentjes (2003)). These will be less than they would have been in a freer trading market.

The environmental effectiveness of the scheme is not secured, because of the relative target. In 2006, there will be an evaluation of the system with the option of reducing the standard to 40 g per GJ if the objective of 55 ktonnes seems unlikely to be achieved.

The United Kingdom is studying a similar system.

3.2.4 Trading in the waste sector

In the wake of the EU packaging and packaging waste directive, the UK government implemented the packaging recovery notes system in which companies obligated under the relevant legislation (the UK packaging waste (producer responsibility) regulations) have to provide evidence that they had recycled and recovered the required amount of packaging waste. The companies could either comply individually, or join one of the 'compliance schemes'. The form of evidence is known as the packaging recovery note (PRN). These are issued by reprocessors when material is actually recycled or recovered, and are sold to firms or compliance schemes.

The system that has emerged is a *de facto* trading system in which PRNs are traded as a form of evidence of meeting packaging obligations.

The system does, in essence, work. Some early shortcomings relate to design issues rather than fundamental flaws. They include absence of sanctions for those who fail to meet their obligation in terms of PRN purchases and lack of legal status of the PRNs, allowing other forms of compliance evidence in the system.

The PRN system has contributed to reducing the weight of packaging, as a means of reducing the tonnage obligation, and has had some effect on encouraging re-usable packaging, and has resulted in low compliance costs.

The costs of packaging recovery and recycling in the UK system, as measured through the price paid for PRNs, cannot be compared with the much higher costs of systems such as that in Germany. The costs of the German DSD system cover collection, separation and reprocessing and recovery. The UK PRN price effectively covers the marginal costs of collecting and reprocessing additional tonnes to meet the prevailing targets set for industry, not the cost, for example, of collecting household packaging waste. The German system achieves very high rates of packaging recycling and recovery from the household stream. The UK system attempts to 'just comply' with the EU directive, while the German approach is to set targets which go beyond the minimum required under the directive.

The Dutch system of tradable manure rights in the agricultural sector is an example of a system where the government is involved by buying back rights and thus decreasing the cap without harming the farmers.

3.3 Concluding remarks

Evidence from tradable systems in the USA already showed strong potential in terms of effectiveness and efficiency ([20]). Since experience with such systems in Europe is limited, statements about effects are based on expectations rather than revealed performance.

A major point concerns the potential friction between the functioning of the quota markets and the legal obligations of market parties to comply with technical standards. Flexibility of market parties should be optimal, allowing them to make full use of the option to buy allowances instead of reducing emissions themselves. Existing legislation, such as the IPPC directive, might be in the way. Future modified and new legislation at the EU level

([20]) Cf. Burtraw and Palmer, op. cit.

should take account of possible new emission trading schemes, in particular where such schemes emerge at the national level, such as for NO_X and SO_2.

Moreover, where emission trading schemes evolve at the national level, countries should design them in a way that allows for connection to other national schemes and possibly schemes at the EU level, in order to benefit from a market that is as broad as possible, with as large an increase as possible in the number of participants. Guidelines could be made available for such designs at the EU level.

'Grandfathering' of allocations gives windfall gains to some participants. Furthermore, the choice of sector caps in the national allocation plans can lead to imbalances of burdens across sectors within a country and different burdens on the same sectors of industry across countries, raising concerns of 'unfair' treatment.

The costs to stakeholders of meeting targets through ET are rarely likely to be prohibitive. Depending on initial allocations, some participants stand to benefit financially, while the potential of instruments to stimulate more rapid diffusion of cleaner technologies, as well as innovation, may generate dynamic benefits (which are not always foreseen by those engaging in ex ante analysis). In short, costs are not going to be high, and there could be some benefits. Administrative costs could be high if many small sources are included.

4 Environmental taxes and charges, environmental fiscal reform

4.1 Background

As set out in Chapter 1, environmental taxes find their rationale in the objective of internalisation via correct pricing of environmental use. Ideally, the tax rate is set at the level of the marginal damage or external costs, although such costs are hard to assess in practice. Continuing attempts have delivered results, e.g. in the EU-financed ExternE ([21]) and NEWEXT projects, for example for the electricity generation sector. External costs have been assessed at 1–2 % of GDP in total, and the costs of coal use in electricity generation, for example, should be increased by 0.02–0.08 euro per kWh for full internalisation, up to twice the net production costs.

The main difficulties in assessing external costs are the lack of market information (by its nature), the spatial and temporal variation in externalities, and the scientific uncertainties in the relationship between emissions and environmental impacts. The environmental damage costs of acid deposition may be higher in vulnerable natural areas than in 'stone deserts', and the health costs may be lower. The marginal welfare loss to neighbours caused by a motorcycle passing through a residential street during the night may be considerable, whereas the same motorcycle may cause no marginal welfare loss at all, when it is part of a dense traffic flow during peak hours.

In practice authorities who design environmental taxes to influence behaviour commonly use a 'second-best' approach. Environmental targets are determined as the result of a political process and the tax rate is set at a level that should result in achieving these targets, rather than equalising marginal external costs.

The United Kingdom, however, has had some experience with attempting to base the rate of the landfill tax on the marginal damage cost of landfills (see Box 2).

The development of the UK landfill tax illustrates the difficulty of using external costs as the basis for tax rate design, as it has abandoned that approach, and followed a 'second-best' approach by increasing standard tax rates far beyond what had originally been determined as optimal.

4.2 New developments

4.2.1 Overview of tax bases

In 2000 EEA described developments in the use and impact of environmental taxes (EEA, 2000). It appeared that the use of taxes had expanding since 1996 and that more tax bases were being used. An overview of the tax bases applied in fifteen EU and two EFTA countries (EEA-17) in 2000 and 2004, based on available data ([22]), is presented in Figure 2. The use of taxes is widening further, with more taxes on CO_2, sulphur in fuels, and waste disposal and raw materials, plus some new product taxes, as a major development.

A comparison of the tax bases in the new EU-10 with those in other (applicant) countries is shown in Figure 3. The EU-10 apply significantly more environmental taxes than the other European countries, in particular with regard to air pollutants and products. Most of the EU-10 and other countries use taxes on raw materials.

A new development (not captured in the graphs) is the move towards better integration of the environmental and other costs of the use of road transport infrastructure.

4.2.2 Internalising the external costs of road transport

Taxes (not including VAT) make up 40–60 % of the sales price of motor fuels in Europe. This is a considerable burden compared, for example, with

([21]) www.externe.info.
([22]) Mainly database for OECD/EEA database for economic instruments and voluntary approaches, and EEA, 2000.

Box 2 The UK landfill tax and external cost calculation

The United Kingdom generates about 29 million tonnes of municipal solid waste a year and in 2002 approximately 77 % of this went to landfill.

The United Kingdom introduced the landfill tax in 1996 with the intention of internalising the externalities associated with landfill. The initial tax rate was derived from assessments of external costs, and based on consultations with industry, local authorities and environmental groups.

The tax is applied to all waste that is disposed of at licensed landfill sites, although there are some exemptions. There are two rates of tax, a lower rate of GBP 2 per tonne that applies to inert/inactive waste (typically construction waste) and a standard rate applicable to all other types of waste, originally GBP 7 per tonne, increasing by GBP 1 per tonne each year. From 2005/06, to help reaching the targets of the Landfill Directive, the standard rate is set to rise by at least GBP 3 per tonne per year until it reaches GBP 35 per tonne. The rate in 2005 is GBP 19 per tonne.

To make the tax revenue neutral, its implementation was accompanied by reductions in employers' national insurance contributions. Some revenues have been earmarked for waste management research and investment projects in landfill areas.

The UK Treasury is working on mechanisms to earmark revenues from the increasing tax to help business address issues of waste management, in particular approaches to improve resource efficiency through waste minimisation.

the US. The consequence is a much higher energy efficiency of the European car fleet, and a much lower per capita emission of CO_2 from transport than in the US. However, transport is a major and growing contributor to environmental problems, and a rationalisation of transport taxes could help to curb that. Road pricing systems have the potential of more directly and accurately charging transport for the creation of environmental externalities, as well as for the economic costs of accidents and congestion, and the use of the environment.

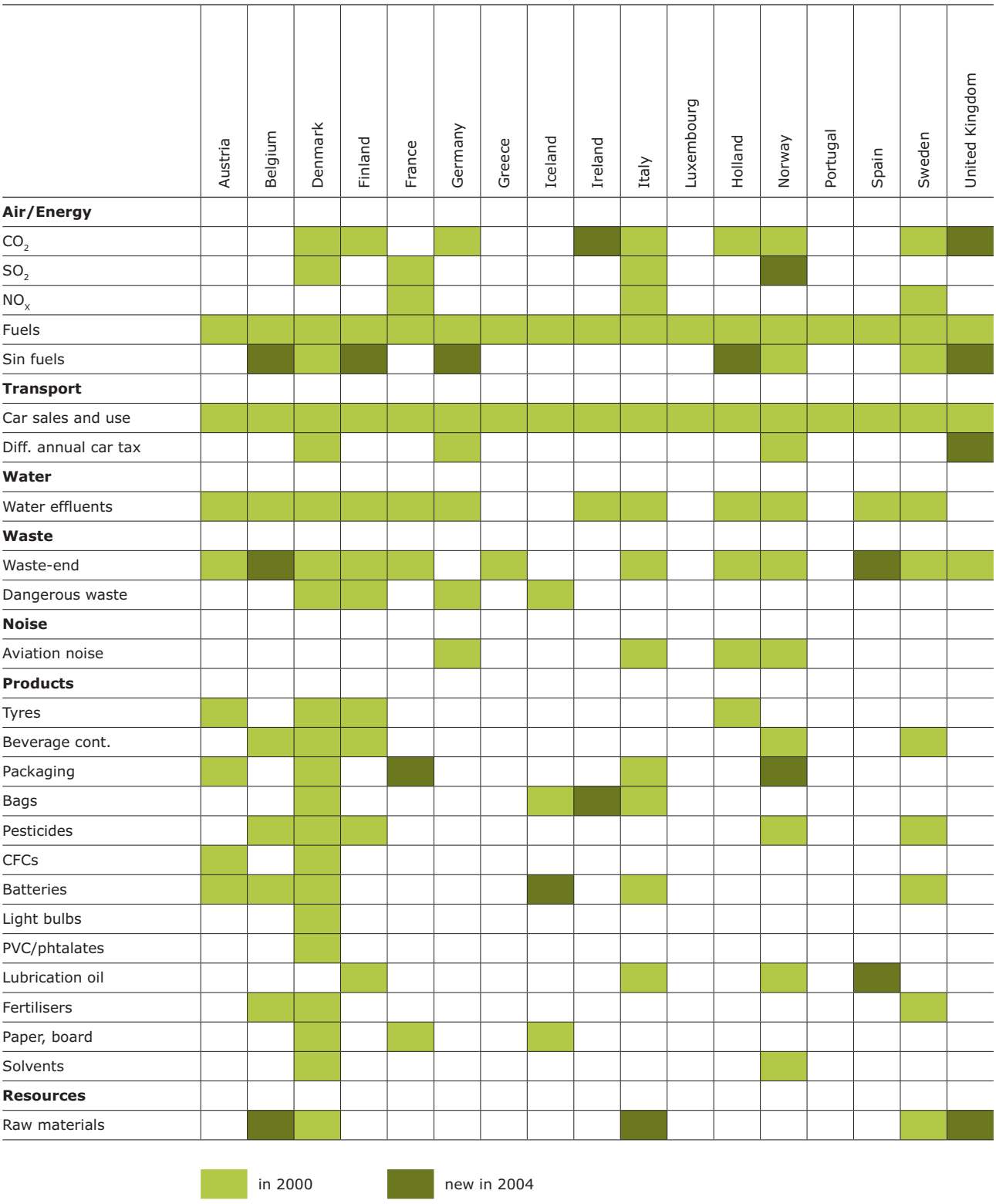
The Commission's White Paper 'Fair payment for infrastructure use — a phased approach to a common transport infrastructure charging framework in the EU' (CEC, 1998) reflects developments in two European countries, which illustrate the will to better align payments from road users with the costs they actually cause. Switzerland introduced an environmental standard-dependent, kilometre-based, charge for heavy vehicles in 2001. Germany has introduced a similar charge for the use of its road infrastructure, making use of recently-available technology. Plans to introduce congestion charging in the Netherlands were shelved at the turn of the century, but are now back on the political agenda.

The new congesting zoning system in the inner city of London appears to have been a success (see Box 3).

A range of taxes and charges are applied to road transport in the EU. The focus in terms of the burden on the transport sector is on vehicle and fuel taxes. Variable charges for the use of infrastructure are still rare. Vehicle taxes are fixed and affect ownership rather than use. Fuel taxes vary with the fuel used and are, apart from their fiscal, revenue-raising function, the appropriate instrument to internalise the costs of climate change effects. The tax rate could be lowered if climate change were to be the only purpose. Most other negative effects are distance- rather than fuel consumption-related, and, following the marginal social cost pricing principle, could better be addressed by a kilometre charge (see also ECMT, 2004). Increased revenues could be offset by abolishing fixed vehicle taxes, and under likely scenarios would still be sufficient to finance infrastructure developments (Roy, 2003).

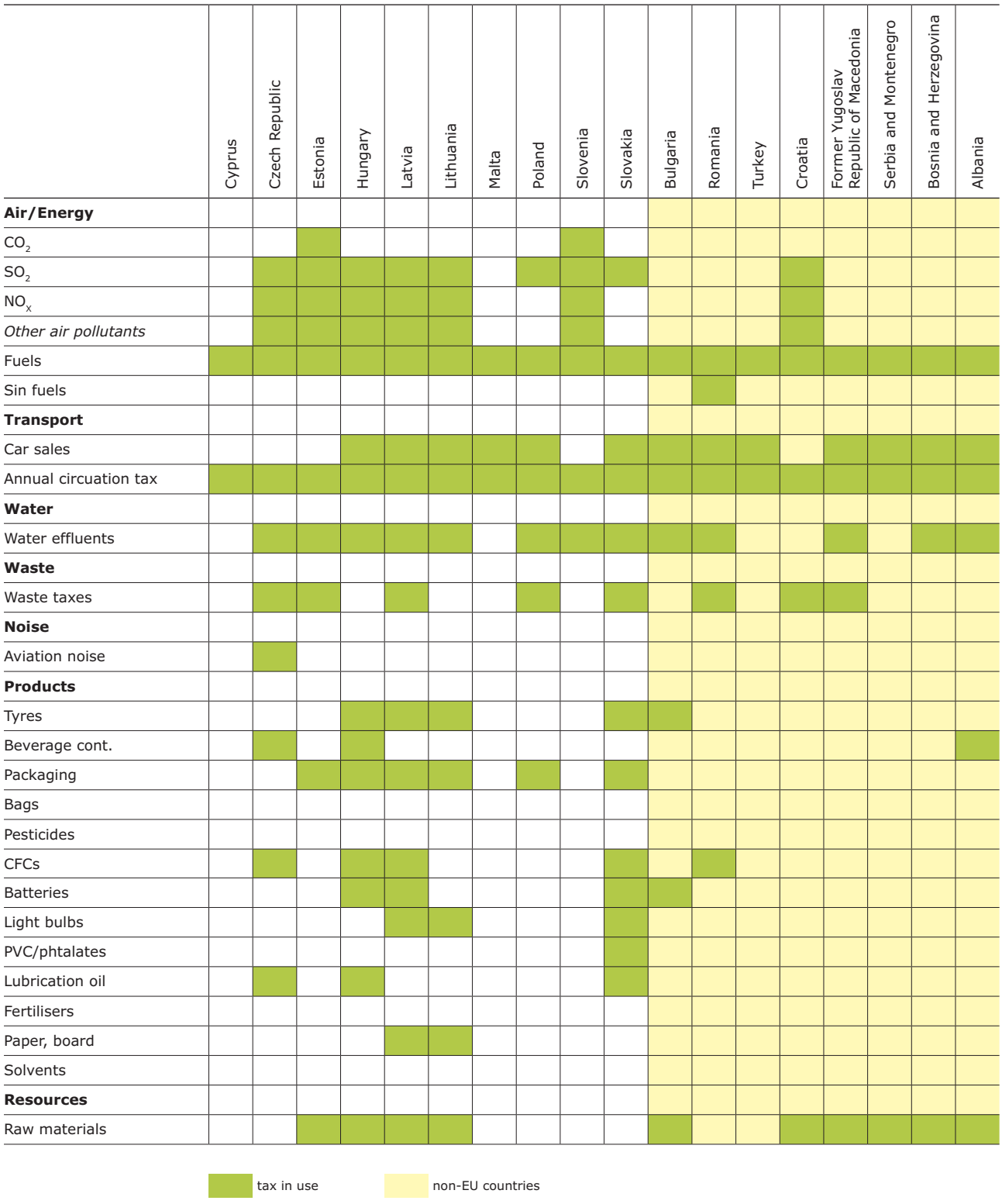
In July 2003 the Commission presented a proposal to amend the so-called 'Eurovignette'-Directive on the charging of heavy goods vehicles for the use of certain infrastructures (CEC, 2003b). The proposal would allow Member States to introduce distance-related charging for heavy goods vehicles over 3.5 tonnes. The proposed charge calculation methodology is a mix of an average cost and a marginal cost approach. The charge should 'be related to the costs of constructing, operating, maintaining and developing the infrastructure network concerned, including any infrastructure costs designed to reduce nuisance related to noise and costs of actual payments made by infrastructure

Figure 2 Development of environmental tax bases in EU-15, Iceland and Norway since 2000



Sources: including:
EEA (2000) Environmental taxes — Redent developments in tools for integration, Copenhagen;
OECD/EU database for environmental taxes (http://www1.oecd.org/env/policies/taxes/index.htm).

Figure 3 Overview of environmental tax bases in EU-10 and other countries, 2004



= non-EU countries

Source: OECD/EEA database for environmental taxes (http://www1.oecd.org/env/policies/taxes/index.htm).

Box 3 Congestion charging in London

A congestion charge was introduced in central London on 17 February 2003. The main aim of the scheme was to reduce traffic congestion in and around the charging zone. Revenues would be used to improve transport in London more generally. Vehicles entering central London, or those parked on the capital's streets, on weekdays during the day, were subject to a GBP 5 daily charge, increased to GBP 8 in July 2005, which can be paid electronically. The charging zone covers 22 km^2 in the heart of the capital within the inner ring road. Certain vehicles, e.g. taxis, motorcycles, buses and alternatively-fuelled vehicles, are exempt, while some users, e.g. residents and the disabled, benefit from discounts.

A recent review of the charging system (Transport for London, 2004) found that congestion within the charging zone has reduced by 30 % and that the volume of traffic has reduced by 15 %. Bus services in the zone have improved and public transport, more generally, has coped with the displaced car users, although some users dispute this. The evidence suggests that the charge has had little direct negative impact on business, but has had benefits in terms of environmental amenity and reduced traffic emissions.

There is currently a consultation on whether the scheme should be extended to cover more or less double the area of the existing charging zone.

operators corresponding to objective environmental elements such as for example soil contamination, and to the direct or indirect costs of accidents which, not being covered by an insurance system, are borne by society.' Intangible environmental costs are not included, but the charge may be differentiated according to these costs.

4.2.3 Environmental taxes and climate change

In 1990 Finland, followed by the other Scandinavian countries, Estonia, Germany, Italy, the Netherlands, Slovenia and the United Kingdom, introduced new or amended taxes on fuels or charges to address emissions of CO_2. Attempts at the EU level to introduce a CO_2/energy tax have been abandoned, and emissions trading is the main economic instrument at this level. Energy taxation has remained on the EU agenda, and in 2003 the directive on energy products taxation was adopted, setting higher minimum rates on some fuels and introducing taxes on others. The new tax rates, to be gradually implemented in the coming years, do not directly reflect the carbon content of the fuels. Neither are they meant to address only climate change effects, since the consumption of energy products has a number of adverse environmental impacts. For some fuels, e.g. those used in transport, the minimum tax rate may be sufficient to internalise external costs, at least for climate change. For others, the levels may be too low. The minimum level for electricity generation, for example, is
0.05–0.1 cent per kWh, dependent on the client. According to ExternE, the price of electricity generated from coal should be raised by 0.02–0.08 euro per kWh, depending on source and location, to correct the price for use of the environment.

Some countries are making big efforts to achieve their greenhouse gas reduction targets, and in most cases the national climate change taxes are part of a larger policy package. Policy mixes can include all three main categories of policy instruments, and sometimes several market-based instruments work alongside voluntary approaches. Enevoldsen (2005) has analysed the impact of various policy mixes in three European countries (Austria, Denmark, the Netherlands) on attempts to reduce CO_2 emissions through improving energy efficiency, changing fuel mixes in energy conversion, and promoting renewable energy generation. He concludes that the use of market forces, i.e. both taxes and subsidies, in Denmark has proved to be a much more effective form of policy intervention than other approaches, such as the Dutch mix of long-term voluntary agreements and subsidies, and the relative 'laisser faire' policy in Austria. In Denmark, industry improved its CO_2-intensity by 25 % in seven years from 1993–2000; the econometric analysis shows that at least 10 % resulted from the CO_2 tax. The impact came about both through fuel switches and energy efficiency, each accounting for about half the CO_2 reduction.

The question arises as to whether complex policy packages, as well as the design of the several instruments, facilitate or impede the achievement of efficient solutions. Sorrell (2003) analysed the UK climate change package and points to the differences in climate change levy rates on carbon, giving a preferential treatment to high carbon-content fuels such as coal. Another conclusion is that some changes, particular affecting climate change agreements (CCAs), are needed in order to make compliance with the EUETS possible. In the package, CCAs might not be challenging enough, implying

Box 4 The Danish packaging tax

The tax on packaging introduced in 1999 replaced another, much more narrowly-defined tax, which applied only to bottles and jars. The former tax was volume-based and applied only to liquids such as drinks, vinegar, edible oil and methylated spirits.

From 1999 to 2001, the packaging tax was broadened so as also to be based on weight when it came to taxing sales packaging and multi-packs with volumes of less than 20 litres for the packaging of specific articles. Initially the aim was to treat packaging with fiscal equality irrespective of the character of the packaging material.

The aim of fiscal equality between materials was changed in the revision of the taxes in 2001, when the government decided that the environmental impact of different packaging materials should be reflected in the tax rate. The taxes were differentiated on the basis of an index of environmental impact, carbon dioxide emissions, primary energy and fossil resource use. Different rates were applied to one-trip and multi-trip packaging, with the tax base being weight for the former and volume for the latter. This reflects the fact that multi-trip packaging generally needs to be heavier to withstand the associated handling.

Source: Nordic Council, 2002.

that the 80 % reduction in the tax rate, granted to firms that have concluded a CCA, would actually constitute an implicit subsidy. This highlights a key problem with exemptions linked to sectoral targets — the problem of asymmetric information, in which targeted sectors may have better information concerning current emissions, as well as abatement costs, than the regulator.

4.2.4 Taxes, charges and deposits in waste management

Taxation affecting waste generation and disposal is widespread in Europe. Seventeen countries apply taxes on waste disposal and/or incineration. Fifteen apply a tax or charge on packaging items; and almost all have deposit-refund systems in place.

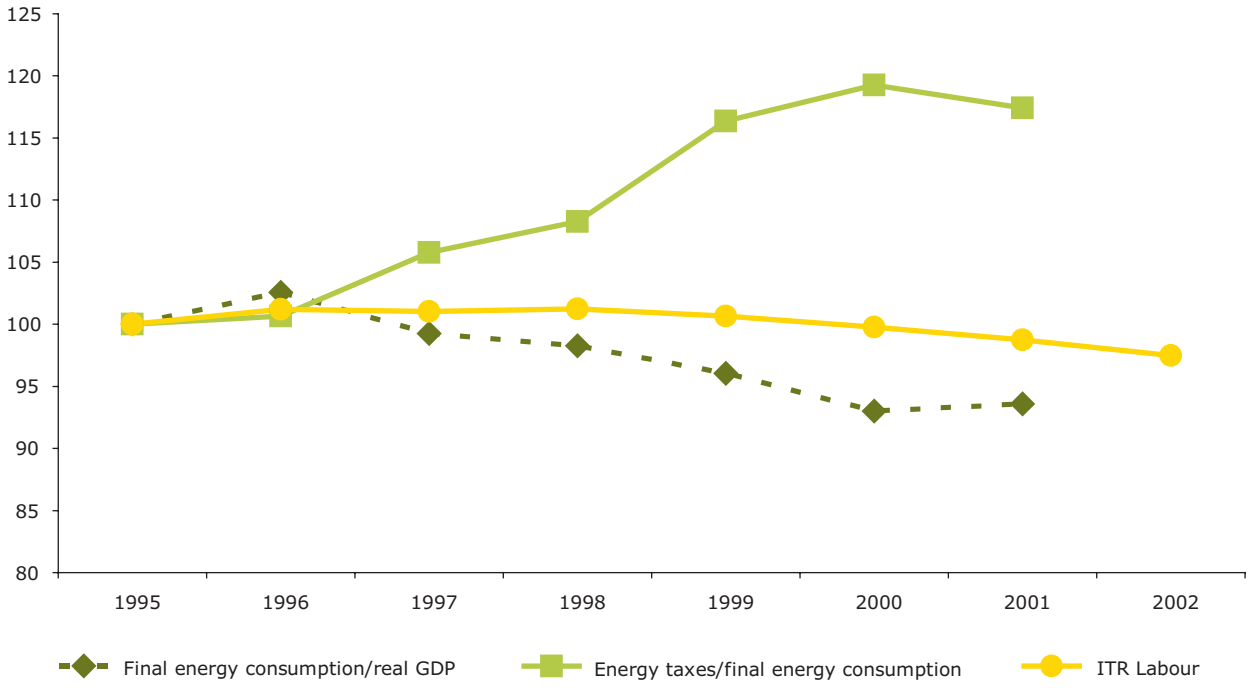
Many of the new waste taxes were introduced at the time of increasing attention to environmental tax reform. The revenues from taxes on non-hazardous waste disposal, for example in Denmark, Finland, the Netherlands and the United Kingdom, go to the public budget and offset other taxes or social contributions by employers or employees.

Whether or not taxes on final disposal affect those who generate the waste depends on the way in which taxes or charges are levied on waste producers. For example, where households are concerned, unless variable charges are levied, the bill for municipal waste collection may rise, but it does not change when individual citizens make an effort to reduce the waste stream. Increasingly, municipalities are considering 'pay-as-you-throw' systems where the price paid for waste management services varies with the quantity of waste sent for disposal. This can be done via a charge on waste sacks, different prices for different sizes of waste bins, frequency-based charges, weighing at the point of collection, or a combination of one or more of these.

Packaging waste is an important component of the municipal waste stream, and may account for a quarter or one-third of the weight of household waste. Taxes on packaging aim to reduce the use of packaging and encourage the use of returnable packaging, supporting deposit-refund systems. Box 4 illustrates the use of packaging taxes in Denmark. An originally dominant fiscal characteristic, equal financial treatment, has given way to a tax design that better reflects environmental damage by the different forms of packaging, in order to make the tax more environmentally effective.

The recycling and recovery of packaging waste is regulated at the EU level (packaging waste directive). The directive stipulates that countries that wish to go beyond the targets may do so '*…on condition that such measures avoid disturbances on the internal market..'*. Germany introduced a mandatory deposit on beer, soft drinks and mineral water in disposable cans and bottles on 1 January 2003, because the share of refillable containers had fallen below a certain level (72 %) set in accordance with the German 1991 packaging law. The German authorities had stated that refillable packaging is environmentally better according to life-cycle analysis (LCA) studies. The packaging industry stated that differences were too small, and that LCA should not be used to compare types of packaging but to improve environmental characteristics. The Commission stated that the introduction of mandatory deposit distorts the internal market, and creates a trade barrier, in the case

Figure 4 **Evolution of energy intensity, implicit tax rate on energy and on labour in the EU-15, 1995–2002**



Source: Eurostat, 2004.

of mineral water which, according to EU legislation, must be bottled at the source.

This case — running in 2004 at the Court of Justice — illustrates potential conflicts between national environmental policy targets and international trade principles. Domestic industry may *benefit* from the deposit, because it may be too expensive for foreign firms to set up deposit-refund systems. It also suggests that life-cycle-based analyses of what are complex systems of collection logistics, reprocessing and industrial production are likely to constitute contested territory as far as attempts to understand environmental impacts are concerned.

4.2.5 Environmental fiscal reform

Environmental fiscal reform (EFR) focuses on shifting the tax burden from welfare-negative taxes (on labour, capital, consumption) to welfare-positive taxes (on environmental externalities), and on reforming subsidies, some of which are harmful to the environment and may have outlived their original purpose.

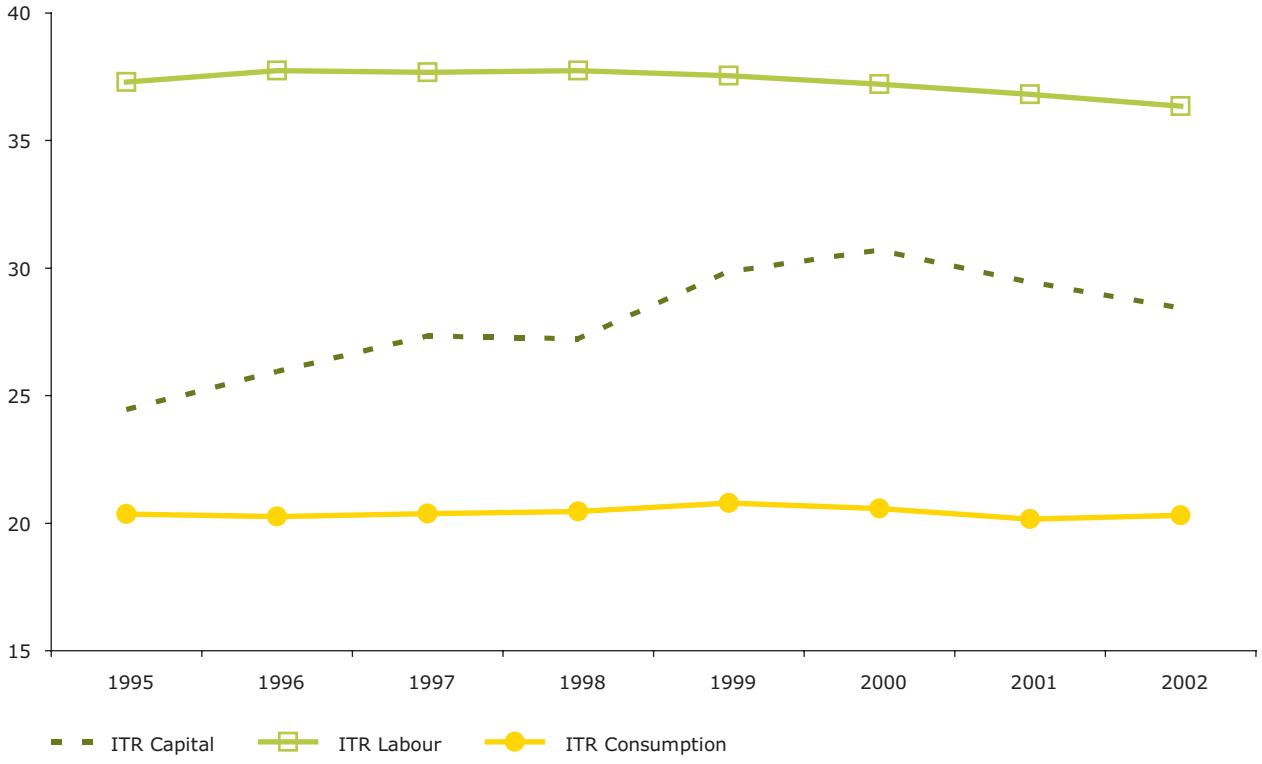
Ex ante evidence of shifting the tax burden can be discovered from political plans and intentions. In many cases reductions in labour taxes or social contributions are announced together with initiatives for new or strengthened environmental taxes, for example on energy and waste. The Swedish government launched a 10-year programme (2001–2010) for tax reform with a total of EUR 3.3 billion being shifted from personal income tax and social security contributions to environmental and energy taxes, including on CO_2 and SO_2.

Ex post evidence of a tax shift may be derived from tax revenue statistics. Data on revenues of environmental taxes are collected on an annual basis. These exclude charges and other levies that are levied for specific purposes. Energy taxes make by far the largest contribution to total revenues. Eurostat analysed the development of energy tax indices and labour tax indices over the years 1995 to 2002 (Figure 4).

Energy tax revenues have risen and the average effective tax rate on labour ([23]) has dropped,

[23] Measured by implicit tax rate (ITR), which equals social security contributions of employers and wage earners + other non wage labour costs + personal taxes on wages and salaries, divided by total pre-tax labour income.

Figure 5 **Effective tax rates on labour, capital and consumption (in %) EU-15, 1995–2002**



Source: Eurostat, 2004.

indicating a *de facto* shift of the tax burden from labour to energy. The graph also shows that overall energy efficiency in the EU has improved, in parallel with increased energy taxation. There may be a causal relation, though a strong causal link cannot be concluded from the above figure (since this may reflect a continuing change in industrial structure, for example).

At the Member State level, green tax shifts have occurred in Denmark, Finland, Germany, the Netherlands, Austria, Sweden and the United Kingdom, countries that have actually implemented environmental tax reform. However, a similar relative tax shift is also discernable in Ireland and Luxembourg, which did not formally introduce ETR.

The question of the potential for further tax shifts, for example from labour towards the environment, may arise. Information on the shares of the tax revenues of the various tax bases in total tax revenue is needed. Figure 5 shows the tax rates on the main economic factors. The tax burden on labour is the highest, although it is slowly declining.

The shares of the several types of environmentally-related taxes in total tax revenues are shown in Table 1.

If a decrease in the share of labour tax were financed by an increase in environmental taxes, a shift of 1 percentage point would imply a reduction of the taxes on labour by 2 % and an increase in environmental tax revenues by 15 %. That would require not only bending the downward trend since 1997, but also a considerable expansion of the revenues of environmental taxation.

Table 1 **Shares of taxes on energy, transport and pollution/ resources, and on labour 1990, 1997 and 2002**

	1990	1997	2002
As % of total tax revenues			
Energy	4.7	5.2	5.0
Transport	1.3	1.3	1.3
Pollution/resources	0.2	0.3	0.2
Total environmental taxes	6.2	6.7	6.5
Labour taxes	49.7	50.8	51.0

Source: Eurostat, 2004.

Of the three components of environmentally-related taxes, taxes on transport have been rather stable in the recent past. The scope for significant expansion depends on the options for increasing one-off taxes (car registration) or annual circulation taxes. For reasons of reducing differences in tax treatment and better pricing, the trend is towards reducing fixed taxes, and shifting towards taxes or charges based on the use of the infrastructure. With a shift from fixed and unrequited taxes to variable and requited charges (e.g. for maintenance and improvement of infrastructure), the potential for ETR would decrease rather than increase. If countries follow the recommendation of the European Conference of Ministers of Transport (ECMT), and charge for the use of infrastructure on the basis of marginal social cost pricing, revenues are likely to be larger than the revenues foregone by abolishing fixed transport taxes and energy taxes (Roy *et al.* 2003 and ECMT, 2003). If such revenues are not earmarked (as ECMT recommends), then they can be a source for ETR.

A relatively growing but still tiny part of environmental tax revenues comes from taxes on pollution and resources. This share (0.2 % of total tax revenues) covers all environmentally-related taxes not imposed in the transport and energy sectors, and includes taxes on waste, water pollution, air pollution, chemicals and packaging. As far as levies are being applied in these domains, charges are dominant. Their revenues are used outside the fiscal domain and are not available for shifting the tax burden. Clearly the scope for developing the pollution and resource taxes as a major driver of environmental tax reform is negligible, at least in the near future.

That leaves energy taxes, the main component of environmental taxes, with a share of about 5 % of total tax revenues. The burden of energy taxes is unevenly spread over target groups (Eurostat, 2003), with the bulk of the burden resting on consumers. In the Nordic countries, for example, households consume about 20 % of all energy, but pay about 60 % of all energy taxes. By far the biggest contribution comes from taxes on motor fuels (petrol and diesel). Energy carriers such as coal, and heavy and light oil, typically used in manufacturing, are taxed at a much lower level, mainly through reduced tax rates.

Within the body of environmentally-related taxes, the largest scope for a shift would be found in broadening the energy tax base by abolishing reductions for commercial sectors and establish a more level treatment with households. There are concerns of competitiveness that would work against substantial increases in such tax rates. Moreover, high taxes on commercial energy use would act as incentive to divert from the taxed energy carriers and increase the potential for renewable energy sources. This would be beneficial for the environment, but would erode the tax base and reduce the potential for tax shifts.

Another potential source of revenues could be the taxing of energy products currently not subject to taxation, such as aviation fuel (i.e. kerosene tax for commercial aviation). However, bringing the aviation sector into the EU emission trading scheme would limit the possibility of tax shifts using revenues generated by taxing aviation fuel, unless auctioning allowances are used to create revenues. In addition, the interplay between different economic instruments, such as environmental taxes and emissions trading, will be of relevance when considering the implementation of ETR in the future because of the foregone revenue-generating effect in the case of grandfathering. Furthermore, there will be a plea for reducing taxes in those parts of the commercial sector that already fall under the EU emissions trading system for greenhouse gases, in particular in the case of tightening targets and shrinking allocations, and in those parts of the commercial sector that might come under the scheme in the future.

The other part of environmental fiscal reform — addressing environmentally harmful, economic subsidies — is a subject of the next chapter.

4.2.6 Concluding remarks

Over time, countries are making greater use of environmental taxes, and are designing taxes more closely relevant to the environmental issue being addressed. Examples include fuel tax differentiation with regard to sulphur content, the use of road infrastructure (Austria, Germany, the United Kingdom), the pesticides tax in Norway (with the tax rate differentiated according environmental and health risks), and charging for waste collected at the household level in proportion to the volumes offered (sacks, bin size, frequency and weight, or combinations of these). This evolution may, in some cases, reflect changes in technology, which allow such taxes or charges to be levied. This suggests that tax design may increase in the accuracy of its targeting as technology develops.

Tax design is also improving through better design of the financial impact on the target groups. A proven mechanism is recycling of the revenues to the tax payers on a basis neutral to the environmental

problem addressed (such as the NO_x charge and refund system in Sweden). Combinations of taxes and voluntary approaches are also being found, where reductions in the tax rates are offered in exchange for in-company environmental programmes (such as the climate change agreements in the United Kingdom). Most energy tax systems have reductions or exemptions for internationally-competing sectors, eroding the environmental effectiveness of such tax regimes. The EU energy products taxation directive is a step towards harmonising energy taxation across countries, removing some of the need to spare national sectors for competition reasons.

Few attempts have been made to determine tax rates by measuring externalities. This remains the case despite ongoing research of external effects (such as in the EU research programme ExternE and its successors) and increased familiarity with the term among policy-makers. On the one hand, the scientific basis and reliability of assessed externalities are still limited, on the other, 'perfect' tax rates may not be the correct incentive in imperfect markets.

Shifting the tax burden away from traditional taxes, such as on labour and capital, can improve the functioning of the market, which could result in better conditions for employment (labour) and technological innovation (capital). The potential for easing the traditional tax burden, through shifts towards taxing the use of the environment, seems limited, given the current structure of tax revenues and the approaches taken in MBI policies, such as tax exemptions, and the focus on 'grandfathering' in allocating emissions trading allowances.

5 Subsidies and subsidy reform

5.1 Subsidy reform

Financial support for certain economic activities can have adverse effects on the environment. Such support comes in different forms and does not necessarily involve a concrete monetary transfer. Favourable tax provisions, loan guarantees, and 'soft' loans (those with an interest rate lower than the market rate) are frequently used to support specific activities. Moreover, lack of charging, or charging below the cost price, for public services (water, infrastructure, waste and wastewater collection systems) is common. Another common though not always recognised form of financial support is the failure to fully internalise external costs. All forms of financial support are either explicitly aimed at, or may have as a side-effect, maintaining economic activities at a level not possible without such support. When such activities have negative environmental effects, the damage will be greater than without support, and such support is therefore often characterised under the heading 'environmentally-harmful subsidies' (OECD, 2003), or sometimes 'perverse subsidies'.

Financial support, however, may be justified where it helps to encourage applied research and technological innovation. New, efficient, technology development creates external benefits that subsidies internalise.

Financial support is omnipresent, but the sectors that are mentioned most frequently, and are said to receive the highest levels of support, include agriculture, energy and transport. Although different definitions ([24]) and the lack of statistical information preclude a clear picture of the scale of the issue, estimates have been made. Van Beers and De Moor (2001) estimated that these sectors receive more than USD 700 billion annually in OECD countries. EEA (2004) has summarised energy subsidy estimates in the EU-15, listing a total amount of at least EUR 29 billion annually, of which renewable energy receives more than EUR 5 billion. Neither of these estimates includes the implicit subsidies of not-internalised environmental damage.

There are three principles for assessing the role of both harmful and environmentally-motivated subsidies (which can also be harmful when ill-designed):

- the general need to achieve economically-efficient solutions;
- the balancing of environmental, economic and social objectives in the context of a need to consider the concept of sustainable development;
- the need to reinforce environmental considerations in important economic processes.

The EU strategy for sustainable development (CEC, 2001a) points to the balanced approach that SD demands: 'Achieving this in practice requires that economic growth supports social progress and respects the environment, that social policy underpins economic performance, and that environmental policy is cost-effective.' Support for economic activities is ultimately meant to serve social objectives, because, in the vision of subsidy-providers, activities targeted for subsidies may, without them, lose their competitive position, cease to expand, or even shrink or disappear, with adverse effects on income, income distribution and employment. Assessing the impact of subsidies ultimately implies establishing a trade-off between environmental, economic and social objectives ([25]).

The principle of economic efficiency should not be overlooked. From the perspective of economic orthodoxy, activities that need support are often not efficient in the use of resources. Funds that are made available for this support have been withdrawn (via welfare-negative taxes) from other, more efficient destinations, creating on balance a loss to the economy as a whole. In general, social objectives

([24]) OECD has started to organise broad consultation aimed at establishing a common framework for environmentally-harmful subsidies. The results of first workshop have been summarised in OECD (2003).
([25]) As for example in the fishery sector; see Redmond O'Hanlon's non-fiction story 'Trawler' (R. O'Hanlon, 2004).

are better served when the economy can run under efficient conditions, leaving a fair share of the value-added generated for social benefits. Such efficient conditions include full internalisation of relevant costs for use of the environment.

There may, however, be some argument for differentiating between subsidies for 'traditional sectors' of economic activity, and those made available for new industries and/or technologies. Technology studies, both from within and without the economic tradition, highlight the potential for lock-in to dominant institutional and economic paradigms to occur. This suggests a potentially valid use of subsidies, where they are limited in time, to stimulate new technologies to compete with existing ones, for example in the case of renewable energy technologies.

5.2 Environmentally-motivated subsidies

In the absence of correct pricing of environmental goods and services, financial support for environmentally-benign R&D, investment and/or behaviour may be called for under certain conditions. According to OECD (1974), environmentally-motivated subsidies are deemed not to violate the polluter-pays principle when

- they do not introduce significant distortions in international trade and investment;
- they are limited to sectors which would otherwise have difficulties with complying with environmental requirements;
- they are limited to a well-defined transition period and adapted to the socio-economic problems associated with implementation of a country's environmental policy.

The EU has formulated guidelines for state aid with special provisions for environmental protection (see Box 5).

The provisions in the guidelines for support for renewable energy are based on calculations of external costs and follow a practical approach. 'Member States may grant operating aid to new plants producing renewable energy that will be calculated on the basis of the external costs avoided. These are the environmental costs that society would have to bear if the same quantity of energy were produced by a production plant operating with conventional forms of energy. They will be calculated on the basis of the difference between, on the one hand, the external costs produced and not paid by renewable energy producers and, on the other hand, the external costs produced and not paid by non-renewable energy producers. At any event, the amount of the aid thus granted to the renewable energy producer must not exceed EUR 0.05 per kWh.' (CEC, 2001b).

The environmental technology action plan stresses the need for further technological innovation for enhancing efficient and effective environmental solutions and creating win-win situations in the framework of the Lisbon agenda. It provides funds for sharing the risk of investing in environmental technologies. It may be necessary to revise the EU's guidelines for state aid for that purpose.

Box 5 Guidelines for state aid for environmental protection

New guidelines on state aid for environmental protection were agreed in December 1999 and apply from 2000 to 2007. The new guidelines allow support for a range of activities, including renewable energy, waste management and meeting Community environmental standards, in specified circumstances. They set maximum rates and periods for support, but provide a range of flexible options from which Member States may choose. Aid may be authorized up to a maximum percentage of gross eligible costs, as follows:

- *Aid for investments by firms to comply with new legal environmental standards:* 15 % for small and medium sized enterprises (SMEs);
- *Aid to encourage firms to go beyond mandatory environmental standards:* 30–40 %, with higher rates available for energy-saving, combined heat and power or renewable energy investments;
- *Aid for investment in renewable energy to supply an entire community:* 10 %;
- *Aid for firms in assisted regions:* 5 to 10 percentage points above the regional aid rate.
- *Aid for the rehabilitation of polluted sites* — if the person responsible is not known, 100 % of eligible costs (cost of work less increase in the value of the land) plus 15 % of the costs of the work.

Aid for the relocation of firms: 30 % of eligible costs, plus a bonus for SMEs.

Source: CEC, 2001b.

The polluter-pays principle, in its wider interpretation, would demand that both non-renewable and renewable energy producers fully internalise their external environmental costs. Where this is not happening, the competitive position of the latter vis-à-vis the former may be supported, as a second-best approach.

5.2.1 EU funds

There are several funds at the EU level either totally or partly destined for environmental projects. The current EU LIFE Programme, an example of the former, ran from 2000 to 2004, and has three categories: LIFE-nature; LIFE-environment; and LIFE-third countries. The objective of LIFE-nature is to contribute to the implementation of EU legislation aimed at protecting habitats and species, by supporting nature conservation projects and accompanying measures.

LIFE-environment supports demonstration and development projects to further integrate environment and sustainable development in the areas of land-use planning, groundwater management, climate change, and others, through development of technologies and policies, and dissemination of information.

The objective of LIFE-third countries is to contribute to the establishment of capacities and administrative structures needed in the environmental sector in the countries bordering the Mediterranean and Baltic which do not have association agreements with the Community.

In recent years, there have been moves to integrate environment into other funds that were put in place mainly for economic or social reasons. One example of this is the EU's structural funds.

A cohesion fund was established to support EU-15 Member States with a GNP per capita less than 90 % of the EU-15 average, i.e. Greece, Spain, Portugal and Ireland. The fund covers environmental projects, as well as transport infrastructure projects. A similar fund called Instrument for structural policies for pre-accession (ISPA) has been established for the eight new central European Member States, and for the applicant countries Bulgaria and Romania.

While an analysis of the environmental impacts of these funds would be a major study in itself, it is clear that extensive investment in environmental infrastructures, notably in water supply, wastewater treatment and waste management, would not have been possible without this funding in place.

5.2.2 National subsidy schemes

A recent review (Van der Veen, 2004a) shows that financial support for a multitude of environmental purposes is applied in all countries. In many countries the focus is shifting from loans to fiscal incentives. Environmental funds have been established in some central European and some other countries, based partially on the revenues from environmental charges.

Sustainable technological innovation commonly needs financial support, where it has difficulty crowding out ('locked-in') traditional technology, which is aggravated by the lack of properly internalised external effects in the costs of traditional technology. Distinguishing three phases for maturing technological innovation, financial assistance is usually available for the first phase of development (R&D), and the third phase of expanding market penetration (e.g. fiscal incentives). Financial assistance for the important second incubation phase, where new technology is tried out commercially, requires venture capital, which is broadly lacking. Here there is a limited role for the public sector because of the risk of market distortion, whereas the risk for financers is frequently too great. A risk insurance scheme for first movers, preferably at the EU level, has been proposed to help solve this problem (Van der Veen, 2004b).

Such a scheme could have a large leverage (in terms of the ratio of the amount of capital 'levered' by the scheme to the costs to the public sector), as actors would apply for it only in cases of failure. Other options with high leverage include schemes that provide loans with below-market interest rates, funds with incomes under a favourable fiscal regime, and general support schemes that take over the risks of that part of the costs not expected to be covered by income.

There is little general knowledge about the impact of support schemes and the successes and failures of initiatives for technological innovation. Van der Veen (2004b) suggests establishing a database of these cases at the EU level for sharing experience.

5.3 Concluding remarks

There is a general tension between the provision of financial assistance and the polluter-pays principle, in spite of accepted cases and general guidelines that may be further expanded. Nevertheless, financial support is inevitable in an imperfect market. In a

liberalising energy market, the development and use of renewable energy technology cannot compete with fossil fuel and nuclear energy generation (perhaps with the exception of biomass). If the prices of non-renewable energy are not increased where applicable by internalising its external costs and abolishing subsidies, the price of renewable energy must be reduced. In theoretical terms, inefficiency is countered with inefficient measures.

Subsidies should therefore be applied with care since they use scarce public resources. If they cannot be efficient, they should at least be effective. They should be structured so as to avoid a dependency, by being time-limited or related to some level of market penetration or technological maturity. They should be made relevant to the purpose for which they are designed. They should also be well-targeted and performance-monitored to avoid unintended results such as the creation and involvement of interest groups that seek to profit from them.

There is a special role for public purchasing as a market-creating force for new technology. It is now acceptable for public procurement to take environmental criteria into account so that broader-based measures of value can inform the selection of tenders for public goods and services. In other words, the criteria of lowest price can be complemented by environmental considerations and not be regarded as unfair selection (e.g. see CEC, 2004b).

6 Liability and compensation: a new regime

6.1 EU-wide and national schemes

Liability and compensation have the potential to produce a number of economic impacts, including:

- fines and non-compliance penalties (e.g. for breach of emissions standards);
- the risk of liability and the need (where applied) for insurance or contingencies to cover eventual liabilities;
- the impact of liabilities on price (e.g. in the sale/privatisation of industries, installations and sites the price can be affected by perceived liabilities for cleaning up contaminated land);
- the costs of addressing liabilities (e.g. clean up of land);
- the costs of compensation (e.g. for oil spills).

Liability legislation places responsibility for restoration of the environment or compensation for environmental damage on the polluter, and as such is concordant with the polluter-pays principle in its wider interpretation.

A number of EU Member States have legislation in place. Some examples include:

- Marine environment: Belgium has a liability regime for restoration or monetary compensation of damage to marine areas, with specific attention to biodiversity and site integrity.
- Oil spills are covered by international regimes, with national implementation. Finland runs compulsory insurance and the use of compensation funds.
- Contaminated land/soil liability regimes are in place in many European countries, including Denmark, Finland, France and Ireland.
- Habitats/biotopes: Germany implements legislation that addresses impairments to ecosystems and landscapes. Sweden regulates the restoration or replacement of damaged biodiversity or habitats.
- Contaminated groundwater: liability regimes exist in Denmark, Finland and France.

In France, the Civil Code includes general liability for damage caused to a third party as a result of fault or negligence. It invokes monetary compensation payments from operators. It is widely interpreted to cover environmental damage, including 'unusual' neighbourhood disturbances.

Major accidents have pointed to the need for liability and compensation regulation, encouraging the adoption of proper legislation. One recent example is the disaster with the oil tanker Prestige in November 2002 (see Box 6).

The European Parliament and Council approved the directive on liability for damage to the environment in March 2004 (EC, 2004c). The directive is to enter into force in 2007, by which time all EU Member States must have adopted legislation specifying liability for environmental damages, including damage to biodiversity in Natura 2000 areas.

The legal basis of the directive is the polluter-pays principle, and it is a step towards integrating environmental costs into production costs and in the prices of goods and services across Europe.

The directive covers liability for damage to water, land and species and habitats. It covers concrete and quantifiable damage, including diffuse pollution, where a causal link can be established between the damage and the identified polluter(s). Damaged environment should, as a first priority, be restored to its baseline condition. If this is not possible, complementary and compensatory remedial action is required. The Directive permits environmental valuation, as a last resort, to be used to determine the extent of necessary compensatory remedial measures.

The directive does not evoke any compulsory financing mechanisms such as insurance or central funds, but encourages Member States to promote the development of appropriate systems.

There are a number of exceptions where the directive does not apply. Most noteworthy are exemptions for damage falling within the scope of

Box 6 The Prestige disaster

In November 2002 the oil tanker Prestige, laden with 77 000 tonnes of heavy fuel oil, broke in two off the coast of Galicia (Spain) spilling an unknown but substantial quantity of its cargo.

A major offshore clean-up operation was carried out using vessels from Spain and nine other European countries. The oil from the Prestige affected the Atlantic coast from Vigo in Spain to Brest in France, as well as causing intermittent and light contamination on the French and English coasts. Around 141 000 tonnes of oily waste have been collected in Spain and some 18 300 tonnes in France. The bow and stern sections, which are lying in 3 500 metres of water, are estimated still to contain 13 300 tonnes and 900 tonnes respectively of oil.

Approximately EUR 22 million in compensation is available from the ship owner's liability insurer and approximately EUR 150 million from the International Oil Pollution Compensation (IOPC) Fund established in 1992, making a total of EUR 172 million available for compensation claims. It is estimated that the total losses could amount to EUR 1 100 million, which greatly exceeds the amount of compensation available. For this reason the Executive Committee of the Fund decided in May 2003 that the 1992 Fund's payments should be limited to 15 % of the loss or damage actually suffered by the respective claimants.

So far, only the Spanish government has been partly compensated for costs incurred in connection with the oil spill.

The IOPC Fund decided that from November 2003 onwards the maximum compensation for damage from oil spills would be EUR 240 million

a range of international conventions, e.g. on nuclear liability and liability for accidents happening on water territory.

The directive specifies ways of remedying environmental damage. Primary remediation restores the environment to the same type, quality and comparable value, i.e. full restoration of the damaged environment. Complementary remediation, when full restoration of the damaged environment is not possible, requires the polluter to make other environmental goods and services available, e.g. by improving conditions in an existing habitat or creating a new natural habitat (forest, wetland, etc.) not necessarily connected with the polluted environment. Compensatory remediation requires the polluter to pay for measures to compensate for interim losses occurring before primary and complementary remediation has achieved its full effect.

While valuation of environmental damage is rarely used as a means of underpinning the design of environmental taxes (despite the theory suggesting this as the obvious approach), the EU liability legislation gives techniques for valuing the environment a potentially important role. Box 7 summarises broad categories of valuation techniques.

Although not part of it, the EU liability directive has brought another issue into the limelight: the need for financing mechanisms and insurances. Some national liability schemes include financing and insurance, for example in the case of soil contamination in Denmark and damage by oil spills in Finland. A number of insurance companies already offer insurance for environmental damage, both on compulsory and voluntary basis, and studies are emerging from scientific researchers and insurance companies on the possibility of insuring environmental damage under the liability directive. The insurance sector does not, however, at present want to guarantee the availability of insurance as there are still many uncertainties connected with insurance of environmental damage, for example lack of reliable methods for valuing environmental damage. This perhaps serves to underline the gap between the theory and the practice of environmental valuation since there are few areas where the implications of inaccurate valuations could have more direct financial consequences than in the area of insuring against potential environmental liabilities.

One option is compulsory payment to a compensatory fund or financial guarantees, possibly coupled with operator licensing as required by the Irish EPA. Compensatory funds, however, may encourage free-riding by some operators, who see no incentive to invest in cleaner production methods since they will not be held fully liable for the environmental damage they may cause.

Box 7 Environmental valuation techniques

Stated preference: consumers are asked directly about their preferences and/or willingness to pay (WTP) or accept (WTA) compensation for changes in an environmental good. The former is often used to check affordability in studies on water supply infrastructure and charging and also to check willingness to pay to protect species, which can be an input into decisions on charging for parks. The latter is used to explore specific losses, e.g. from increased noise near airports. There is usually a large difference between WTA and WTP.

Revealed preference: the price of a good is estimated on the basis of real or surrogate markets (e.g. park entrance fees, house prices, expenses incurred to avoid pollution).

Value transfers: modification of estimates obtained through the above methods in order to fit data to another, but similar, environmental attribute.

The question arises as to whether liability should be extended to other entities than the polluter, e.g. to purchasers of possibly contaminated land. Experience from the US suggests that caution is needed. The risk of being confronted with clean-up costs of unknown magnitude may discourage the sale or redevelopment of land with actual or possible contamination, such as former industrial sites (Boyd *et al.* 1999; Segerson, 1999). As a consequence, developing pristine land may be preferred while possibly contaminated, already developed land is left idle. In order to avoid undesirable distortions in land development and purchase, the US EPA cooperates with prospective site purchasers who, in exchange for undertaking clean-up measures, are assured that the EPA will not sue them in the future (Sigman 2001).

6.2 Possible consequences of liability schemes

The adoption of the liability directive and its implementation by 2007 are likely to induce several changes for concerned parties. Production decisions, including choice of technology, location of production and choice of production components, will be weighed more carefully against the risk of having to compensate for environmental damage and/or premiums to be paid to insurance companies.

The currently rather limited market for environmental insurance can be expected to develop significantly in future. Insurers may as a consequence exert greater influence on production decisions in order to reduce the risk of accidents.

Research into and development of environmental technologies can be expected to increase. One approach envisaged is that insurers/governments will reward companies that spend resources on developing environmentally-cleaner production, for example by reducing insurance fees or fees to central funds (in this respect creating a mixed economic instrument).

Producers, in internalising the environmental costs of production, will pass on a proportion of any increase in costs to consumers, if market conditions allow them to do so.

The overarching question is to what extent the new regime will lead to behavioural change. Experience from the US (Anton *et al.*, in press) suggests that the threat of liabilities combined with market-based pressures from consumers, investors and other firms are significant motivators for operators to adopt more comprehensive environmental management systems (EMS), which leads to integrated approaches to including environmental concerns in business management. With appropriate support from authorities and consumer awareness, liability regulation could promote a similar course for operators in Europe. This would effectively strengthen not only the polluter-pays and precautionary principles but also the global principles of environmentally sustainable economic growth and decoupling of economic growth from environmental degradation.

6.3 Concluding remarks

The decision as to who takes the liability can result, *de facto,* in a subsidy, e.g. implicit government acceptance of historical pollution of land or government acceptance of accident risk in nuclear power.

Liability schemes and complementary technical requirements have not so far been strong enough to

avoid avoidable problems, some of which — notably oil pollution disasters — have taken catastrophic proportions.

There are many cases in Europe where compensation for damage to health or loss of amenity is not forthcoming. In addition, the structure of the insurance market options is not yet sufficiently sophisticated to offer appropriate signals to encourage operators to take appropriate action. There remains a moral hazard in full insurance coverage — as full coverage can reduce the incentive to implement risk minimisation /problem avoidance measures.

References

Andersen, M.S., 2000. Designing and introducing green taxes: institutional dimensions, in: *Andersen, M.S. and R-U. Sprenger 2000, Market-based instruments for environmental management — politics and institutions,* Edward Elgar, Cheltenham, UK.

Andersen, M.S. and R-U. Sprenger, 2000. *Market-based instruments for environmental management — politics and institutions,* Edward Elgar, Cheltenham, UK.

Beers, C. van, and A. de Moor, 2001. *Public subsidies and policy failures. — how subsidies distort the natural environment, equity and trade, and how to reform them,* Edward Elgar Publishers, Cheltenham, UK.

Bohm, P., 1999. *International greenhouse gas emission trading — with special reference to the Kyoto Protocol,* Nordic Council of Ministers.

Boyd J., 1999. Environmental Remediation Law and Economies in Transition. Discussion paper 99–21. Resources for the Future, Washington DC.

Burtraw, D. and K. Palmer, 2004. SO_2 Cap-and-trade program in the United States: A 'living legend' of market effectiveness, in W. Harrington, R.D. Morgenstern and Th. Sterner (eds.) *Choosing environmental policy — comparing instruments and outcomes in the United States and Europe,* RFF Washington.

CEC, 1993. 'Towards sustainability' — 5th Environmental Action Programme.

CEC, 1998. Fair payment for infrastructure use, a phased approach to a common transport infrastructure charging framework in the EU, White Paper COM98(466)final.

CEC, 2001a. A sustainable Europe for a better world, EU strategy for Sustainable Development, COM(2001)264 final.

CEC, 2001b. Community guidelines on state aid for environmental protection, (2001/C 37/03).

CEC, 2003a. Developing an action plan for environmental technology, COM (2003)131 final.

CEC, 2003b. Proposal for amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures, COM(2003) 448 final.

CEC, 2004a. A comparison of EU air quality pollution policy and legislation with other countries, by AEA Technology and Metroeconomica.

CEC, 2004b. Buying green! A handbook on environmental public procurement, SEC(2004) 1050.

Dales, J.H.; 1968. Pollution, Property & Prices: an Essay in Policy Making and Economics, University of Toronto Press.

EC, 1994. Directive on packaging and packaging waste, 94/62/EC, amended by 2004/12/EC.

EC, 2000. Water Framework Directive, 2000/60/EC.

EC, 2003a. Energy Products Taxation Directive, 2003/96/EC.

EC, 2003b. Emissions Trading Directive, 2003/87/EC.

EC, 2004. Environmental Liability Directive, 2004/35/EC.

EEA, 2000. *Environmental taxation — recent developments in tools for integration,* Environmental issues report No 18.

EEA, 2004. *Energy subsidies in the European Union: a brief overview,* Technical report 2004/1.

ECMT, 2004. Charging for the use of infrastructure, CEMT/CM(2004)20.

Enevoldsen, M., 2005. *The theory of environmental agreements and taxes — CO_2 policy performance in comparative perspective,* Edward Elgar, Cheltenham UK.

Eurostat, 2001. Environmental protection expenditure in Europe 1990–1999.

Eurostat, 2002. Environmental expenditure in accession countries — data 1996–2000.

Eurostat, 2003. *Energy Taxes in the Nordic Countries — Does the polluter pay?* Final report prepared by the National Statistical Offices in Norway, Sweden, Finland and Denmark, Luxembourg.

Eurostat, 2004. Structures of the taxation systems in the European Union — data 1995–2002.

Hahn, R.W., 1999. The impact of economics on environmental policy, AET-Brookings Joint Center for Regulatory Studies.

James, D. 1997. Environmental Incentives: Australian Experience with Economic Instruments for Environmental Management, Environment of Australia.

Johnstone, N., 2003. Efficient and effective use of tradable permits in combination with other policy instruments, OECD.

Kreiser, L.A. (ed.), 2002. *Critical issues in international environmental taxation — insights and analysis for achieving environmental goals,* CCH Inc. Chicago through tax policy.

Mountondo, E.G., 1999. The Polluter Pays Principe, EGM Consult.

Nentjes, A., 2003. The Netherlands Case. Paper presented at the CATEP workshop 'Maximising the Potential of Emissions Trading in Advancing Sustainability Agendas in an Expanded European Union — the role of Research', European Parliament, Brussels,Thursday, May 22, 2003.

Nordic Council of Ministers, 2002. *The Use of Economic Instruments in Nordic Environmental Policy 1999–2001,* TemaNord 2002:581, Copenhagen.

OECD, 1974. Recommendation on the implementation of the Polluter Pays Principle, C(74)223.

OECD, 1989. *Economic instruments for environmental protection.*

OECD, 1994. *Managing the environment: the role of economic instruments.*

OECD, 2001. *Environmentally related taxes in OECD countries — issues and strategies.*

OECD, 2003. *Environmentally Harmful Subsidies — Policy Issues and Challenges.*

O'Hanlon, R., 2004. *Trawler*, Penguin Books.

RIVM, 2005. *Nationale Milieuverkenning 5,* 2000–2030.

Klinge Jacobsen, H., Birr-Pedersen K and Wier, M., 2005. *Fordelingsvirkninger af energi- og miljøafgifter* Roskilde: Risø National Laboratory.

Roy, R. *et al*., 2003. Comparison of current charges with an efficient scenario, ECMT's Group on Financial and Fiscal Aspects.

Segerson K. and Dawson N.L., 1999. Liability transfers: A US perspective. Paper Prepared for 'Liability, Economics, and Insurance', Odense, Denmark, October 22–24, 1998.

Sigman H., 2001. Environmental liability in practice. In: Heyes A (ed) (2001) *The law and economics of the environment*. Edward Elgar. Cheltenham UK and Northampton MA USA.

Sorrell, S., 2003. Turning an early start into a false start: Implications of the EU emissions trading Directive for the UK Climate Change Levy and Climate Change Agreements, OECD Paris.

Sterner, Th., 2003. *Policy instruments for environmental and natural resource management,* RFF/World Bank/ SIDCA.

The Carbon Trust, 2004. *The European emissions trading scheme: implications for industrial competitiveness.*

Tietenberg, T., 2001. 'The Tradable Permits Approach to Protecting the Commons: What Have we Learned?' Paper presented at the Concerted Action on Tradable Permits (CATEP) Workshop on Trading Scales: Harmonising Industry, National and International Emission Trading Schemes hosted by Fondazione ENI Enrico Mattei, Venice, December 3-4.

Tinbergen, J., 1952. *On the Theory of Economic Policy.* Amsterdam: North-Holland Publishing Company.

Tol, R. The marginal costs of carbon dioxide emissions (note).

Transport for London, 2004. Congestion Charging Impacts Monitoring: Second Annual Report, London. *http://www.tfl.gov.uk/tfl/cclondon/cc_monitoring-2nd-report.shtml.*

UK Department for Environment, Food and Rural Affairs (DEFRA), 2003. http://www.defra.gov.uk/environment/climatechange/trading/ukets.htm.

UNCED, 1993. *Agenda 21.*

UNECE, 1999. Protocol to the 1979 Convention on Long-range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-level Ozone.

Van den Berg, J.C.J.M. and A. Ferrer-i-Carbonell, 1998. Models of in individual behaviour and implications for environmental policy, Department of Spatial Economics, Free University Amsterdam/ Deparatment of Economics and Economic History, Universitat Autonoma de Barcelona.

Van der Veen, G., 2004a. Policy instruments for sustainable innovation, Technopolis Amsterdam, the Netherlands.

Van der Veen, G., 2004b. Conclusions of the ETAP Conference 'Financial Instruments for Sustainable Innovations', 21–22 October 2004, Amsterdam.

Wier, M., K. Birr-Pedersen, H.K. Jacobsen, and J. Klok, 2005. Are CO_2 taxes regressive? Evidence from the Danish experience, in: *Ecological Economics* 52 (2005) 239–251.

Wolff, G.H., 2000. When will business want environmental taxes? Redefining Progress, San Francisco.

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